'It's Important to Know In Time'
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The Newspaper of the Industry

Air Conditioning & REFRIGERATION NEWS

AN INTERNATIONAL INSTITUTION ★ SUBSCRIBERS ALL OVER THE WORLD ★

'Written to be Read on Arrival'
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How Commercial Refrigeration Protects the Health and Welfare of America—a Complete Survey of a Vital and Essential Industry

Why Commercial Refrigeration Should Receive Materials

A STORY is told of a small-town preacher who had a walk-on part in a home talent play. The villain was to fire a blank at him from a hoss pistol, whereupon the preacher was to jerk out his breast-pocket handkerchief and cry:

"My God! I'm shot!"

The preacher objected to the profanity, and it was agreed that he could substitute "my goodness" for the beseeching of the Creator. On the night of the play, the prop man had an inspiration. Unbeknownst to the preacher, he soaked the latter's breast-pocket handkerchief in red ink. The pistol was fired, the preacher jerked out the handkerchief, took one quick look and gasped: "My God! I AM shot!"

That yarn gives the predicament of the commercial refrigeration industry in any attempt it may make to state its case for receiving high priority rating. Almost every industry can and will make some sort of plausible case for its essentiality.

(Concluded on Page 12, Column 4)

This special section of the News is designed for presentation to OPACS and other government officials, as well as for the education of all who might be interested in commercial refrigeration.

This information, it is hoped, will help pave the way for intelligent allotment of materials to an industry which performs an exceedingly useful function. Just how and why the industry is useful to the nation is told in the following pages.

None of the statistics appearing below have ever been collected before, because of the widely divergent segments which comprise this scattered and hotly competitive industry.

The whole commercial refrigeration picture is so complicated, and the available data in so many cases not only overlaps but has been kept in different forms, that analyzing such data has been an enormously complex job.

Mechanical Cooling Protects All Our Major Foodstuffs

THE TERM "commercial refrigeration," as it has come into general usage in business and industry, means the type of mechanical refrigeration equipment which is used mainly in the processing and preservation of foodstuffs on its way to the consumer's hands.

It is perhaps the major factor in making America's food supply the tops in quality, with a minimum of wastage.

Recent investigations by food technologists have demonstrated that foods properly preserved by refrigeration retain more of their vitamin content than foodstuffs which do not have the benefit of such protection. But that is only a small part of the story. Everyone knows the simple fact that without refrigeration, foods spoil.

Last year an estimated 450,000 commercial refrigeration machines were sold in this country. Of this number it is estimated that 80%, or 360,000 machines, were sold and installed for the

(Concluded on Page 12, Column 1)

At Long Last! All-Industry Commercial Refrigeration Statistics! 1940 Commercial and Industrial Refrigeration Sales In United States And Estimated Amounts of the Materials Used In Their Production

COMMERCIAL CONDENSING UNITS	NUMBER OF UNITS SOLD	DOLLAR VOL. ($000 OMITTED)	MATERIAL REQUIRED (IN TONS) TIN	ZINC	ALUMINUM	RUBBER	LEAD	REFRIGERANT	COPPER	STEEL	IRON	NICKEL
1. LESS THAN 1-3 HP.	79,000	$ 4,319	3	18	39	40	66	118	122	988	2,568	..
2. 1-3 HP.	69,000	5,247	5	29	34	45	99	138	203	1,035	3,105	..
3. 1-2 HP.	40,000	4,410	4	24	22	26	76	80	159	650	2,000	..
4. 3-4 HP.	23,000	3,256	3	17	13	23	59	58	125	589	1,865	..
5. 1 HP	14,000	2,487	3	12	8	18	44	42	97	490	1,575	..
6. TOTAL UNITS SOLD SEPARATELY	**225,000**	**$ 19,718**	**18**	**100**	**116**	**152**	**344**	**436**	**706**	**3,752**	**11,113**	..
SELF-CONTAINED UNITS												
7. WATER COOLERS, COMPLETE..	31,000	$ 3,941	12	99	10	7	15	20	363	1,600	184	..
8. ICE CREAM CAB., COMPLETE..	42,000	8,825	5	234	15	525	103	83	542	6,700	366	..
9. BEVERAGE COOLERS, COMPLETE	61,000	7,351	3	229	20	52	152	87	360	6,600	362	..
10. MILK COOLERS, COMPLETE...	2,000	402	1	20	1	3	6	6	34	370	225	..
11. TOTAL SELF-CONTAINED UNITS	**136,000**	**$ 20,519**	**21**	**582**	**46**	**587**	**276**	**196**	**1,299**	**15,270**	**1,137**	..
12. TOTAL OF LINES 6 AND 12..	**361,000**	**$ 40,237**										
CABINETS ONLY												
13. WATER COOLERS	12,000	$ 998	4	35	..	..	..	..	122	160	..	..
14. ICE CREAM CABINETS	22,000	2,288	1	109	..	261	12	..	197	2,250	..	..
15. BEVERAGE COOLERS	24,000	1,872	..	83	..	7	35	..	93	1,545	..	..
16. MILK COOLERS	8,000	416	..	72	..	..	..	..	80	1,200	..	..
17. TOTAL CABINETS ONLY	**66,000**	**$ 5,574**	..	..	..	..	..	..	..	..	..	..
18. DISPLAY CASES AND MARKET REFRIGERATORS*	**42,540**	**$ 27,000**	**83**	**2,528**	**300**	**1,205**	..	..	**1,305**	**30,773**	..	..
COMMERCIAL AND INDUSTRIAL CONDENSING UNITS—1 HP. AND UP												
19. UNITS FROM 1 1-2 TO 10 HP.	27,367	$ 11,565	..	..	..	..	..	..	..	..	..	..
20. UNITS FROM 11 HP. UP	5,682	12,786	..	..	..	..	..	..	..	..	..	..
21. OTHER EQUIPMENT		122,120	..	..	..	..	..	..	..	..	..	..
22. COMMERCIAL & INDUSTRIAL..	**33,049**	**$146,471**	..	**13,312**	**706**	(CRITICAL MATERIALS ONLY)			**9,375**	**40,812**	..	**172**

*Single-duty cases, 8,800; double-duty cases, 19,800; reach-in cases, 8,500; bakery cases, 640; sectional cases, 3,400; vegetablecases, 1,400.

Figures on materials used will undoubtedly show a margin of error in some classifications (particularly commercial cases and condensing units over 1 hp.) because of incompleteness of the data on hand when this section went to press.

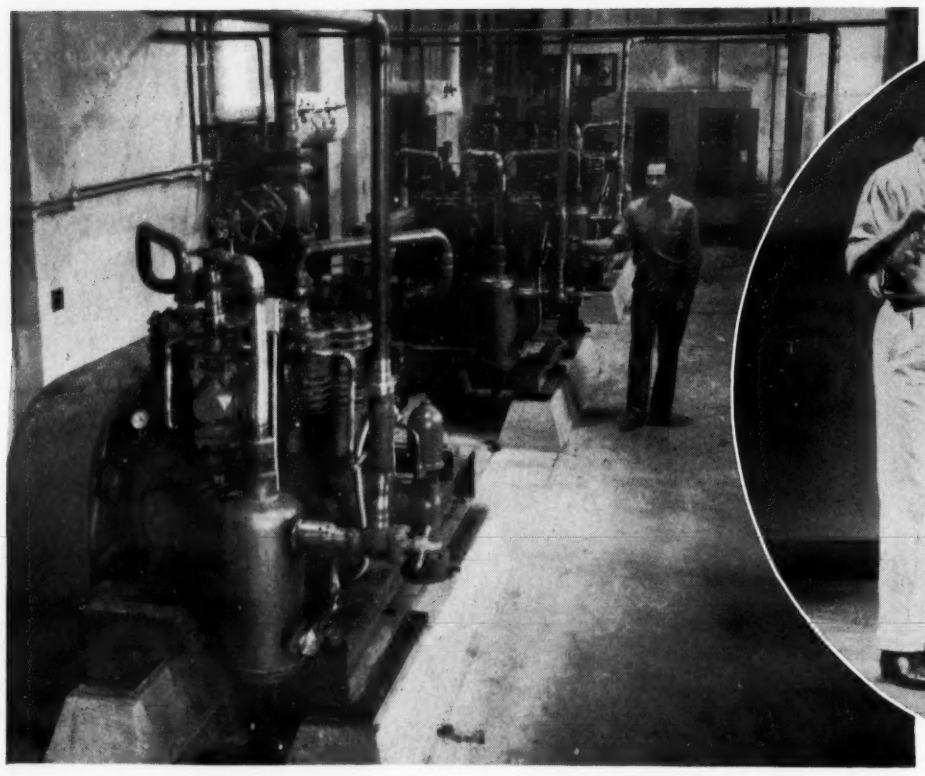
Refrigeration - - Where and How It Preserves Fresh Food For the American People

FOOD MARKETS

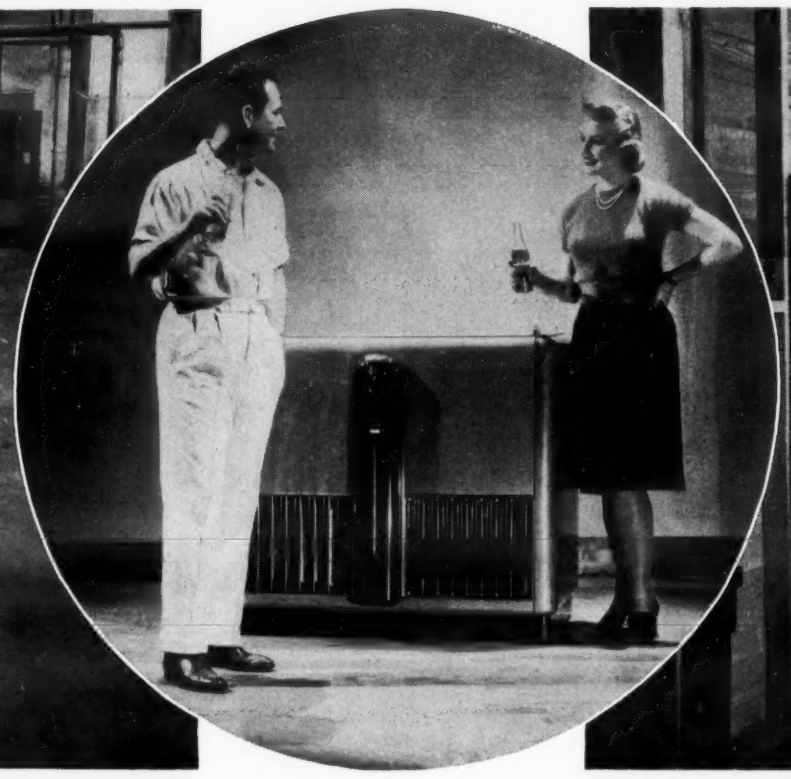
FROZEN FOODS

REFRIGERATED TRUCKS

DEFENSE

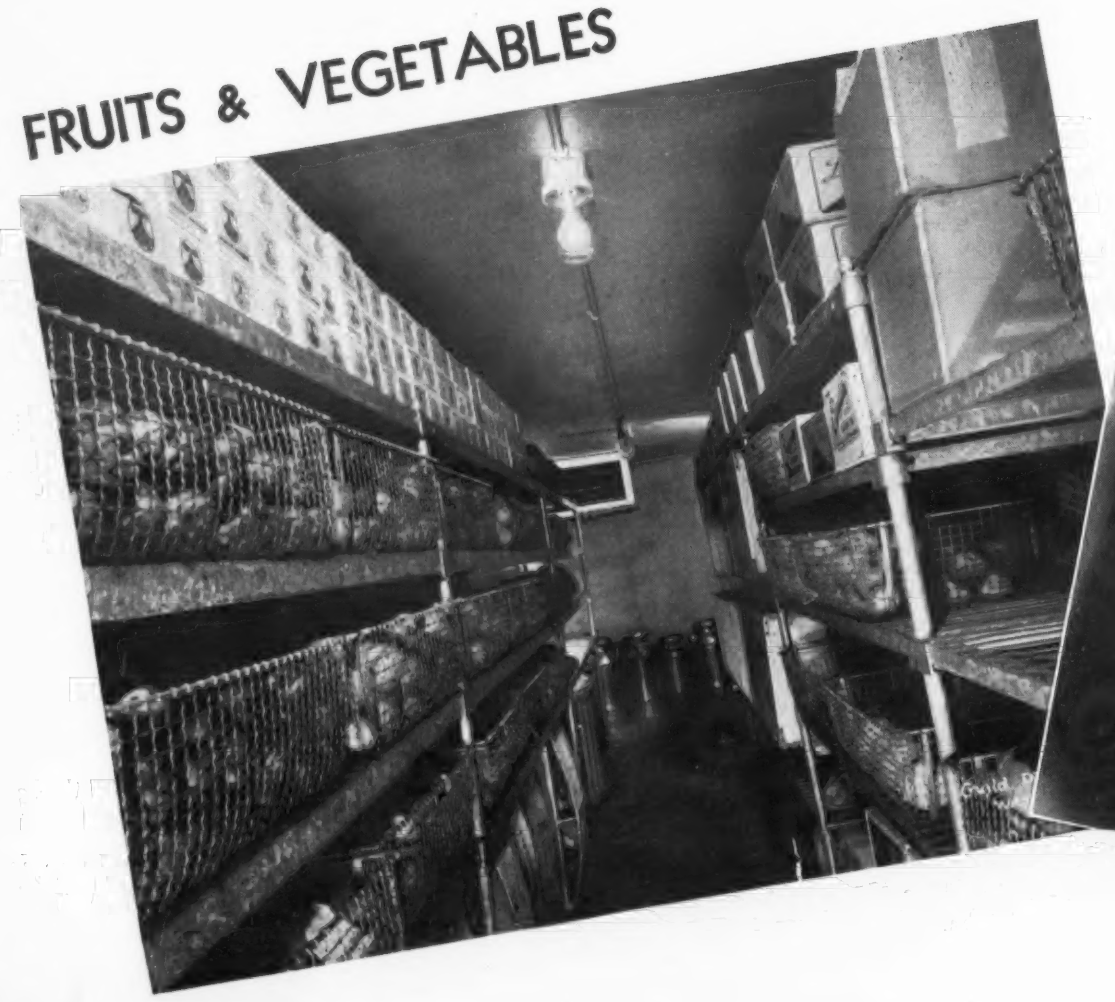


BEVERAGE COOLING

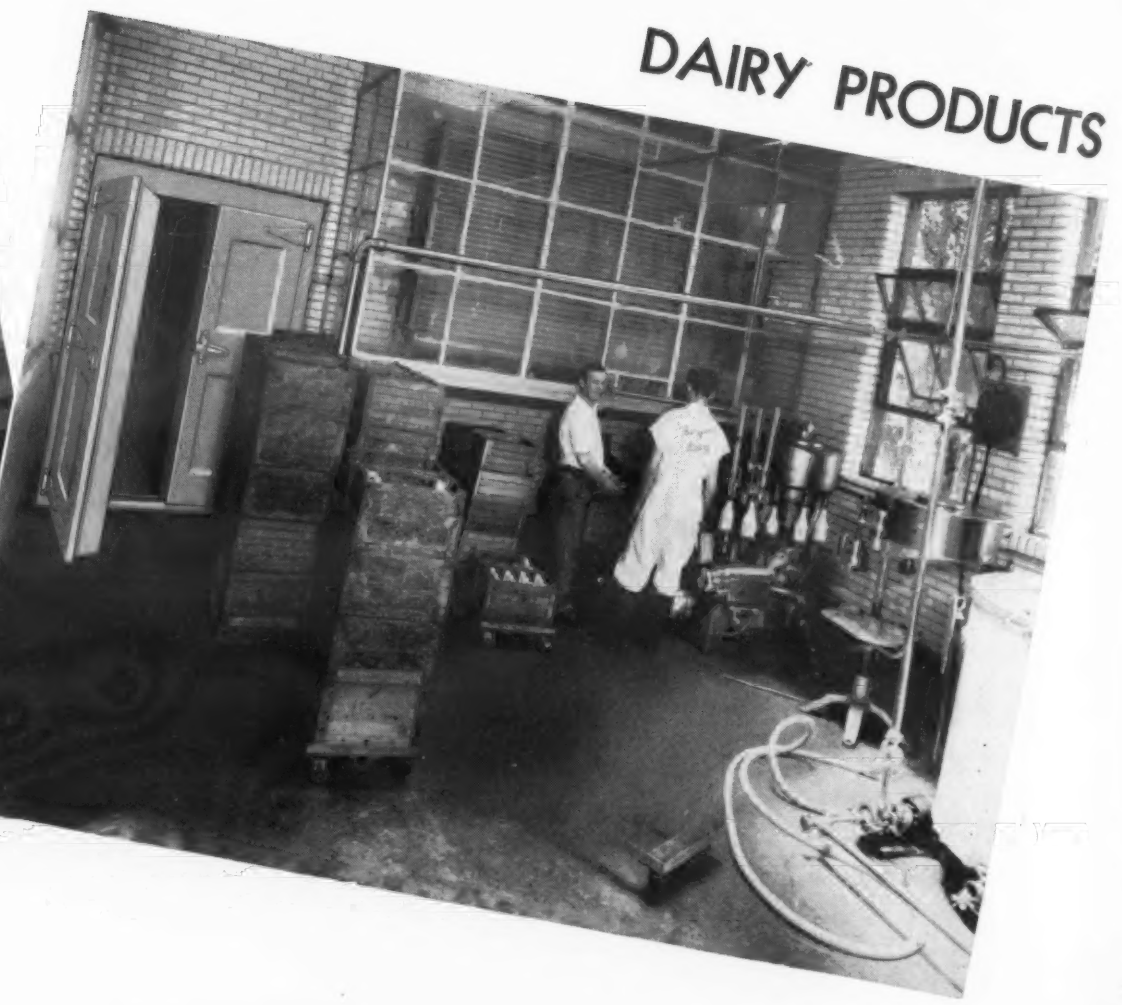


ARMY TRAINING

FRUITS & VEGETABLES

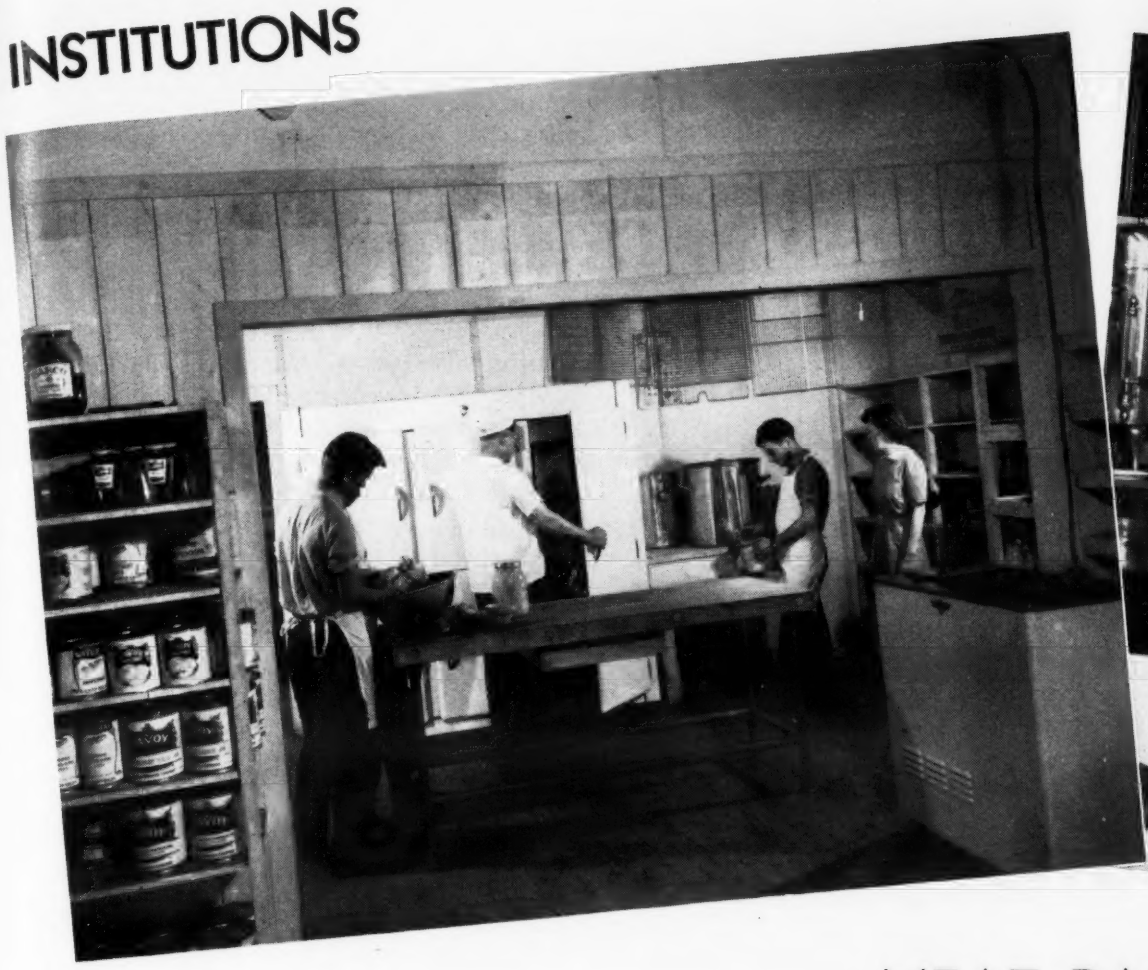


DAIRY PRODUCTS



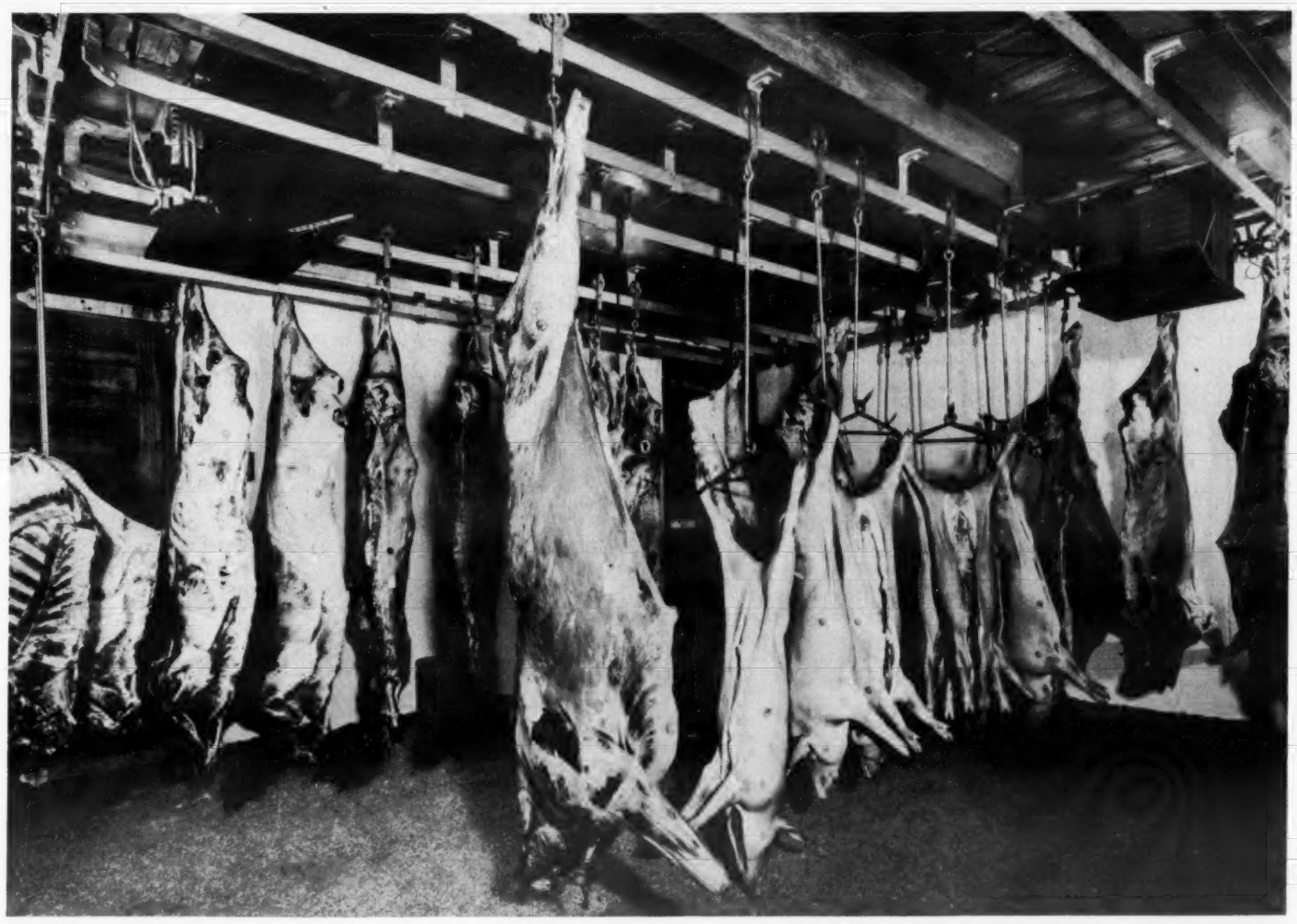
Nearly Every Step In Food Processing and Distribution Calls For Refrigeration

INSTITUTIONS



RESTAURANTS

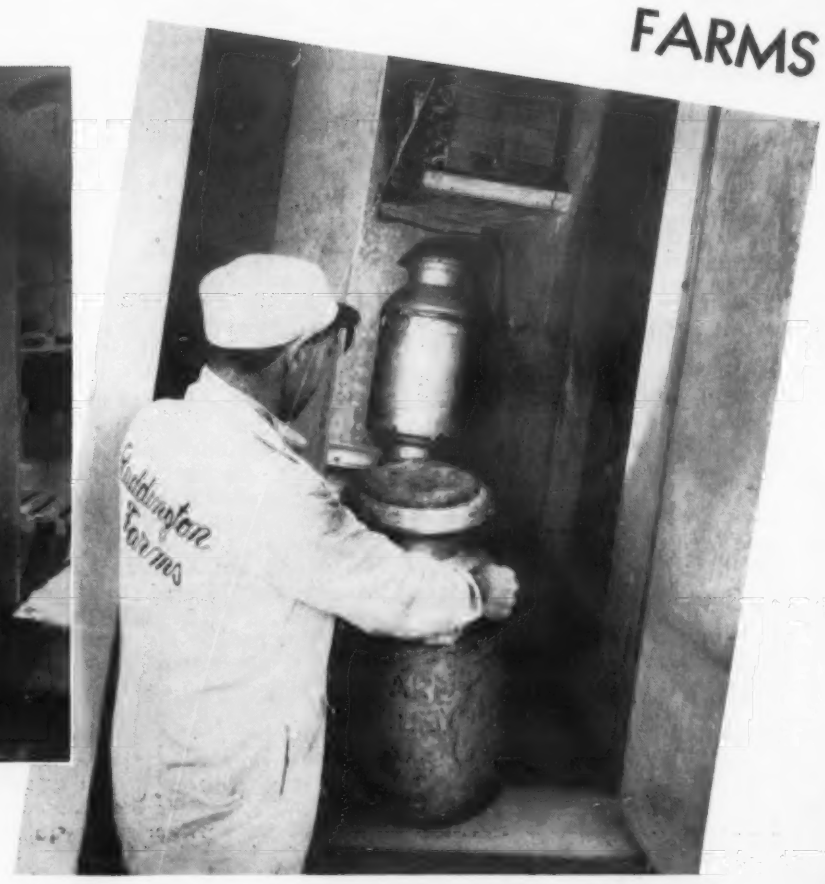
MEAT PACKING



LOCKER STORAGE

BAKERIES

FARMS



Refrigeration's Role In the U. S. Food Supply Setup

(Concluded from Page 9, Column 4)

preservation of perishable foodstuffs. For each machine sold several accessory items and parts must also be manufactured and sold to form the complete refrigeration system which acts as the mechanical heat removing device.

Let us trace briefly the role refrigeration plays in the complex journey from producer to consumer of the four most common types of foods—milk and dairy products, meats, fruits and vegetables, and bread.

It has long been demonstrated that bacterial action begins in milk immediately after milking, and if unchecked, would soon make it unfit for consumption.

Today either by force of state legislation or the demands of the dairy purchasing his product, the farmer has generally provided a more modern method of cooling milk on his farm.

From the farm the milk is taken to the dairy in refrigerated or insulated trucks. At the dairy plant a vast amount of cooling equipment is used to cool the milk after pasteurization and in the processing that creates such dairy products as butter, cheeses, and America's favorite and probably most healthful food novelty —ice cream.

Refrigerated trucks then carry these products to retail stores. In the thousands of retail stores through which such dairy products are sold commercial refrigeration is necessary to preserve **all** dairy products until such time as they are dispensed to a consumer.

Meats

In the meat packing industry refrigeration is of vital importance. Once livestock has been butchered the animal heat must be removed as quickly as possible or the product will soon be subject to the effects of bacterial activity and subsequent spoilage.

From packing plant to consumer all meats—with the possible exception of some smoked varieties—must constantly be under the protection of refrigeration.

Transported across the country in refrigerator cars, unloaded to refrigerated trucks, taken to refrigerated warehouses, and then again by refrigerated truck to the familiar refrigerated display case or storage box in the retail food store—such is the typical journey of the steak that may be served to you tonight.

And commercial refrigeration is a most necessary part of the accommodations in every stage of the journey.

Produce

Not so obvious, perhaps, but just as important is the use of commercial refrigeration in the preservation of fruits and vegetables. Produce from California, Florida, the Rio Grande valley, the Pacific Northwest, or the orchards of New England is carried to warehouses thousands of miles away by refrigerated freight cars or motor trucks (these trucks use ingeniously constructed power plant takeoff systems to drive the refrigeration equipment).

Unless such products are canned, the only way they can be preserved for long periods of time is in refrigerated warehouses. Because the average man sees these products out in the open in the retail store, he may think that they will keep indefinitely.

Refrigeration facilities for such items are provided in the retail stores, as a means of better preserving the freshness and vitamin content of produce.

Bakery Goods

In baking bread, and other bakery products, the baker is dealing with fermentation processes, and thus there is obviously a need for temperature control.

It is necessary to control the temperature of the flour in storage, of the dough mix, of the fermentation room, of the proof box, of the bread cooler, and of the bakery refrigerator.

Where bread is not properly cooled it loses weight, becomes crumbly, and more easily subject to mold.

Dough retarder refrigerators used in the process of retarding doughs and batters are now being used extensively by the retail baker to increase and add flexibility to his production. With such refrigerators doughs can be made up and placed on the pan for baking, then refrigerated, and baked as they are needed.

Two of the more recent developments in the use of commercial refrigeration equipment worthy of special mention here are its application in the processing and preservation of quick-frozen foods, and in refrigerated locker storage plants.

Frozen Foods

Quick-frozen foods have taken a most important role in the food industry of the United States. In the kitchens of hotels, institutions, and restaurants you will find today frozen foods in as great a quantity as any other type of foodstuffs. While this development has not made so large a dent in the retail food trade, nevertheless its growth in use by the householder has been rapidly accelerated in the past few years.

Quick-frozen foods would seem to have a logical place in any part of the emergency or defense plan pertaining to the conservation and stocking up of the nation's food supply. Foods which are quick frozen can be kept indefinitely—if the proper refrigeration equipment is used—and there is no limit to the amount of foodstuffs that can be quick frozen, if there is enough refrigeration machinery available. Furthermore, the foods can be stored in paper cartons, no metal containers being required.

Locker Storage Plants

Refrigerated locker storage plants are a phase of refrigerated food storage that is only a little more than five years old. They are found chiefly in agricultural communities, and consist of an insulated building in which there are from 300 to 700 food lockers, stacked row on row and having much the appearance of filing cases.

Each plant is also equipped with a chill room, maintained generally at —10° F., in which freshly butchered meat brought in by the farmer is chilled down before being put into the locker. The locker rooms are held at from 0 to 10° F.

U. S. Department of Agriculture estimates put the number of such plants now in operation in the country at slightly more than 3,500, but some well-informed members of the refrigeration industry believe that the actual number is in excess of that figure. It seems well established that new plants have been put into operation at the rate of nearly 1,000 a year in the past two years.

These plants have been given definite consideration for a role in the defense program, according to a report made at the May, 1941 meeting of the American Society of Refrigerating Engineers. At this meeting it was stated that:

"The government favors decentralization of food storage and warehousing, and is considering a plan somewhat similar to that used in England. Locker plants fit into this scheme exceptionally well. . . ."

It is apparent from the growth of this field that it fills a need in improving the American standard of living, particularly in rural communities. It is also establishing facilities for storing large quantities of perishable foodstuffs on a decentralized basis, if and when the need might arise for such facilities.

It is also obvious that the refrigerated locker plants, because of the low temperatures which must be maintained, require large amounts of commercial refrigeration equipment.

Replacements

In any contemplation of the use of commercial refrigeration equipment now and in the future, full consideration must be given to the fact that much of the current purchases of commercial refrigeration machines and the accessory items that make up a complete commercial refrigeration system, will be for replacement of wornout or outmoded cooling equipment.

Commercial refrigeration systems are mechanical devices with many parts subject to wear, and corrosion from the volatile liquid known as the refrigerant, which is a necessity in such systems.

Consequently it is estimated that possibly 60% of all purchases of commercial refrigeration equipment now being made for the processing and preservation of foodstuffs are for the replacement of equipment which no longer operate efficiently.

This applies also to parts and accessories which are necessary adjuncts to commercial refrigeration systems—these parts and accessories being comprised of such items as temperature and pressure controls, refrigeration coils and tubing (made of aluminum, copper, or steel), electric motors and their attendant switches and controls, testing instruments, expansion, float and throttling valves.

Meat Packers Buy Largely To Replace Wornout Machines

Importance of the continuance of the manufacture of commercial refrigeration equipment, if the American public is to have an ample supply of properly preserved foodstuffs, is revealed in a special survey being conducted by the American Meat Institute at the request of AIR CONDITIONING & REFRIGERATION NEWS.

Replies from 90 of the leading meat packers in the country who were polled in this survey clearly show that the refrigeration systems of the plants operated by these firms are far from static. Rather, refrigeration equipment is continually being added to or replaced, and as a result these meat packers are continually buying from commercial refrigeration manufacturers new compressors, new condensers and cooling towers, and new unit coolers.

The table below shows the type of equipment which these meat packers reported buying during the past year, and the percentage of this equipment which was used for replacement purposes or for addition to the plants' refrigeration systems:

Equipment	No. of Plants Purchasing	% For Replacement and Repair	% For Addition
Compressors ..	74	43%	57%
Condensers and Cooling Towers	58	40%	60%
Unit Coolers ..	85	24%	76%
Parts, Valves, and Fittings.	185	66%	34%

One Quarter of All Machines Installed Are 9 Years Old

How many commercial refrigeration machines will need replacing in 1942 because they will be worn out, or needing repair so badly that they will be beyond repair?

Well, two years ago (1939) one of the largest companies in the business made a comprehensive survey to determine the age of commercial refrigeration machines in operation at that time.

This survey in 1939 demonstrated that approximately 31.5% of all installed compressors were at least six years old.

That means that in 1942 nearly 25% of all the compressors installed will be nearly 9 years old.

Nine years is a ripe old age for a commercial refrigeration machine that first saw the light of day in 1932. It can be safely said that practically every machine of that vintage will qualify for retirement in 1942.

What We Are Trying To Tell In This Special Section

(Concluded from Page 9, Column 1)

The corset people, the aluminum horseshoe people, the stove people, and so on through the roster of American industry are belaboring OPACS and OPM with well-documented pleas that they are essential to the health, welfare, and morale of the people, and hence should get their customary allotments of critical materials.

OPACS and OPM have heard that tune so often they're sick of it. So now the commercial refrigeration people have to go down to Washington and cry: "Yes, but this time the story IS true. If we can't continue to protect America's food supply, the disaster may be terrific! Epidemics and malnutrition which could follow the impairment of our services would probably kill more Americans than Hitler's bombs ever could! Gentlemen, bored as you may be with such pleas, THIS ONE IS TRUE! America shouldn't have to learn this truth the hard way."

All year the NEWS has been maintaining editorially that commercial refrigeration had just about the most useful function of any "non-defense" industry. Some time ago, after talking with statistics-conscious Joseph Weiner of OPACS, we decided that just making the claim wasn't nearly enough. It should be **proved.**

That's what this special section of the NEWS is all about. It is the "campaign textbook" for the commercial refrigeration industry in its attempt to obtain high priority rating. In pictures and articles, in graphs and charts, in figures and tabulations, it is designed to explain WHAT COMMERCIAL REFRIGERATION DOES FOR AMERICA, and why its productive and distributive facilities should be fed the materials they need to continue their valuable services to the nation.

In the process of so doing, we have fortunately enjoyed the cooperation and contributions of dozens of men and organizations in the industry—groups which never before would reveal their jealously guarded figures, but which in this emergency unselfishly cooperated with the NEWS to portray the commercial refrigeration business in the pages of this "textbook." To all our collaborators, our thanks, and the thanks of a great industry!

Number of Employes and Factory Floor Space In Plants Making Refrigeration Machines

Last week AIR CONDITIONING & REFRIGERATION NEWS, in a quick survey of manufacturers of commercial refrigerating machines, learned the following things about the number of workers employed in making such machines, and the amount of plant space required for the manufacturing operations.

Replies were received from 16 manufacturers, whose volume of business represents approximately 60% of that done by the industry. These replies showed the following:

NUMBER OF WORKERS EMPLOYED 6,470

AMOUNT OF FACTORY FLOOR SPACE (IN SQUARE FEET) 1,521,040

Survey of Refrigeration Supply Jobbers Shows Big Percentage of Equipment Is Sold For Replacement Purposes

On July 10, a survey of 52 out of the refrigeration industry's 228 wholesale jobbers of parts and supplies was completed by AIR CONDITIONING & REFRIGERATION NEWS. It is estimated that 33% of the industry's jobbing business is done by these 52 jobbers. Based on a projection of this survey:

52% OF REFRIGERATION PARTS SOLD THROUGH JOBBERS ARE USED IN NECESSARY REPAIRS AND REPLACEMENT PARTS IN EXISTING INSTALLATIONS.

48% OF REFRIGERATION PARTS SOLD THROUGH JOBBERS ARE USED FOR INSTALLATION OF NEW EQUIPMENT (including 5% of parts sold to manufacturers for production of new equipment).

APPARENTLY 52,000 COMPANIES AND INDIVIDUALS ARE ENGAGED IN SELLING, INSTALLING, REPAIRING, AND MAINTAINING REFRIGERATION EQUIPMENT, ACCORDING TO THIS SURVEY. The large majority of this group includes dealers and distributors, service companies and individual service men. The balance includes building engineers and service men of ice cream and dairy companies, meat packing houses, ice plants, cold storage and transportation warehouses.

228 WHOLESALE JOBBERS OF PARTS AND SUPPLIES, EMPLOYING 1,228 PERSONS AND OPERATING 303 STORES, sell the majority of installation and repair parts used by the commercial refrigeration industry. They provide the connecting link between nearly 1,000 manufacturers of coils, valves, refrigerating compressors, fittings, tubing, etc., and nearly 50,000 customers.

COLLECTIVELY, THE PARTS JOBBERS' BUSINESS in 1940 WAS $23,376,000. Normal inventory investment of the jobber group is $3,777,000, according to the recent survey by AIR CONDITIONING & REFRIGERATION NEWS. Inventory turnover average of the 52 jobbers who answered the survey was 5.1 times annually.

Last year among items necessary to the existence of the commercial refrigeration industry, jobbers sold 6,649,052 pounds of copper tubing (soft and hard) and 10,060 pounds of aluminum tubing.

A few large manufacturers of complete commercial refrigeration equipment market their own parts through company controlled branches, or independent franchised distributors, accounting for approximately 28% of parts sales in this industry.

Meat Goes to Market with Refrigeration

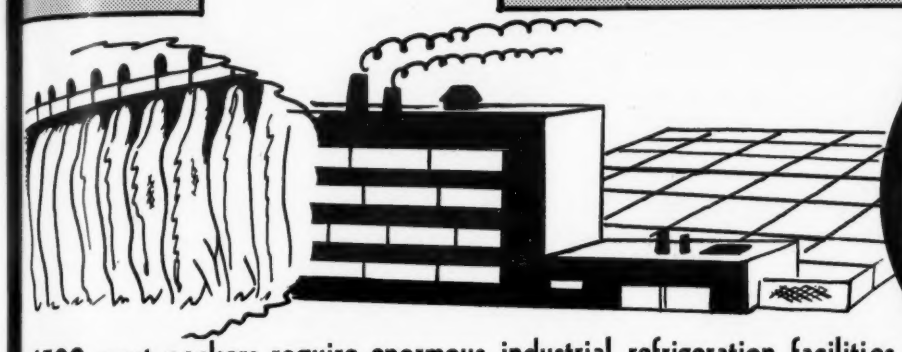
A chart of the route by which meat goes from the farm to the tables of American homes, showing the part mechanical refrigeration plays at every step along this route

On the **500 million** acres of pasture land in the United States, farmers produce **100 million** animals (cattle, sheep, hogs) for market each year

80 million animals are sent to the packing houses

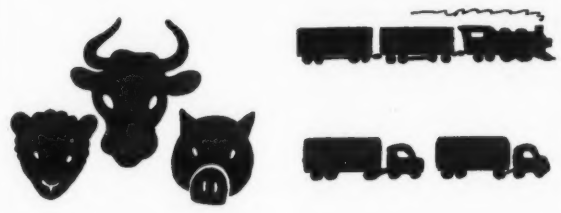
Some are sent to local markets for slaughter

Some are slaughtered at the farm and the meat stored in locker storage plants while others are killed and cured at the farm for family use



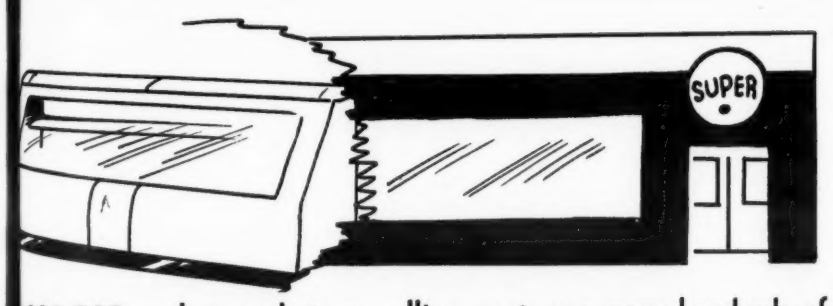
1500 meat packers require enormous industrial refrigeration facilities

Industrial Refrigeration



The meats are shipped by refrigerated trains and trucks

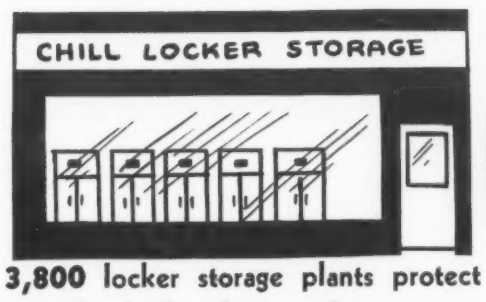
(There are 21,000 refrigerated freight cars in the U. S.)



205,000 markets and stores selling meats use many hundreds of thousands of commercial units

Commercial Refrigeration

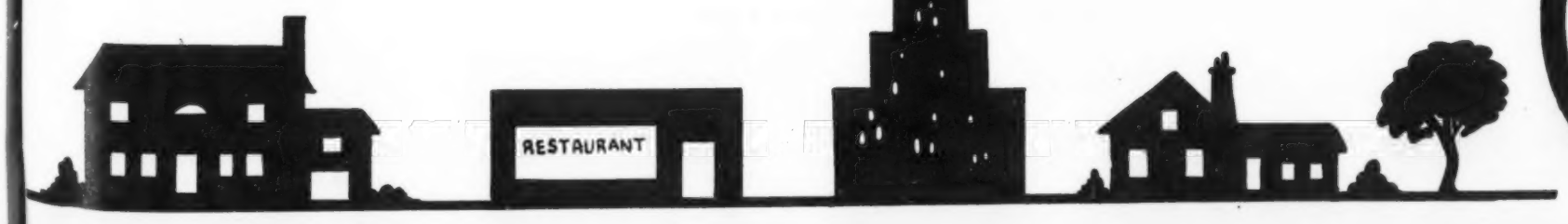
Refrigerated trucks deliver many meats to restaurants, hotels, and at times to homes



3,800 locker storage plants protect foods for farm and city

Industrial Refrigeration

Commercial Refrigeration



Commercial Refrigeration

Household Refrigerators

29 million homes, plus hotels and restaurants, consume **17 billion** pounds of meat, much of which is protected by **15 million** household mechanical refrigerators

361,000 COMMERCIAL REFRIGERATING

What it takes to make 361,000 commercial condensing units:

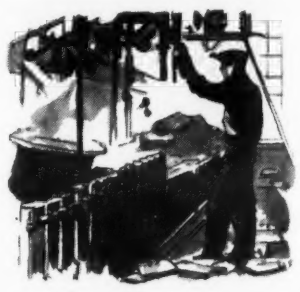
What these materials mean in terms of making a 35,000-ton battleship

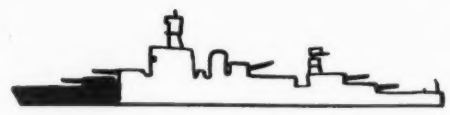
Each symbol represents the amount of that particular material which is used in the manufacture of one battleship; a partial silhouette represents the fractional part of a battleship indicated.

28 tons of tin

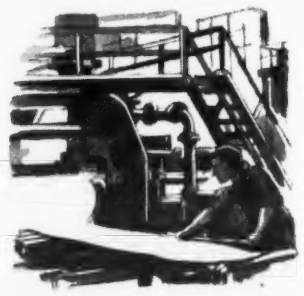
THE TIN USED IN MAKING 361,000 COMMERCIAL REFRIGERATION MACHINES IS THE TIN REQUIRED FOR ABOUT 7/10 OF A BATTLESHIP. THIS ABOUT

153 tons of zinc

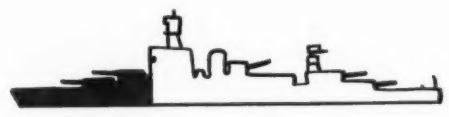




THE ZINC USED IN MAKING 361,000 COMMERCIAL REFRIGERATION MACHINES IS THE ZINC REQUIRED FOR ABOUT 3/10 OF A BATTLESHIP. THIS ABOU

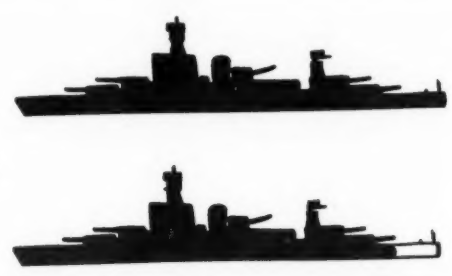


187 tons aluminum



THE ALUMINUM USED IN MAKING 361,000 COMMERCIAL REFRIGERATION MACHINES IS THE ALUMINUM REQUIRED FOR ABOUT 2/5 OF A BATTLESHIP. THIS IS A

232 tons of rubber

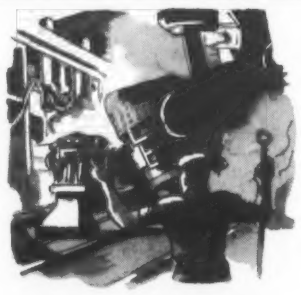


THE RUBBER USED IN MAKING 361,000 COMMERCIAL REFRIGERATION MACHINES IS THE RUBBER REQUIRED FOR 2 AND 9/10 BATTLESHIPS. THIS IS OUT TWO

1,072 tons of copper

THE COPPER USED IN MAKING 361,000 COMMERCIAL REFRIGERATION MACHINES IS THE COPPER REQUIRED FOR ABOUT ONE BATTLESHIP. THIS IS OUT ONE

5,729 tons of steel



THE STEEL USED IN MAKING 361,000 COMMERCIAL REFRIGERATION MACHINES IS THE STEEL REQUIRED FOR ABOUT 1/5 OF A BATTLESHIP. THIS ABOUT O

16,803 tons of iron

NO DATA IS AVAILABLE ON THE AMOUNT OF IRON USED IN A BATTLESHIP. THAT WHICH IS USED SEEMS TO BE CLASSIFIED WITH STEEL. T IRON U

524 tons lead

NO DATA IS AVAILABLE ON THE AMOUNT OF LEAD USED IN A BATTLESHIP. PRESUMABLY THE AMOUNT IS NOT SUBSTANTIAL. THE LEAD USED IN M NG 361,

679 tons refrigerant

Commercial refrigeration condensing units, produced by 37 manufacturers, are one of the first essentials to keeping the nation's food supply safe from contamination. The data pictured above includes all commercial machines for the year 1940, whether sold separately or as a part of a complete application such as water, beverage, or milk coolers. Inadequate

G MACHINES WERE SOLD IN 1940

What these materials mean in terms of total United States consumption

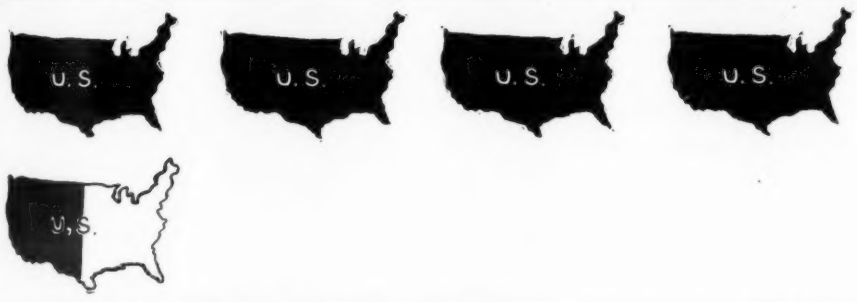
Each symbol represents one five-thousandth part of the total U. S. consumption of the material indicated; a partial silhouette represents a corresponding fractional part of one five-thousandth of U. S. consumption.

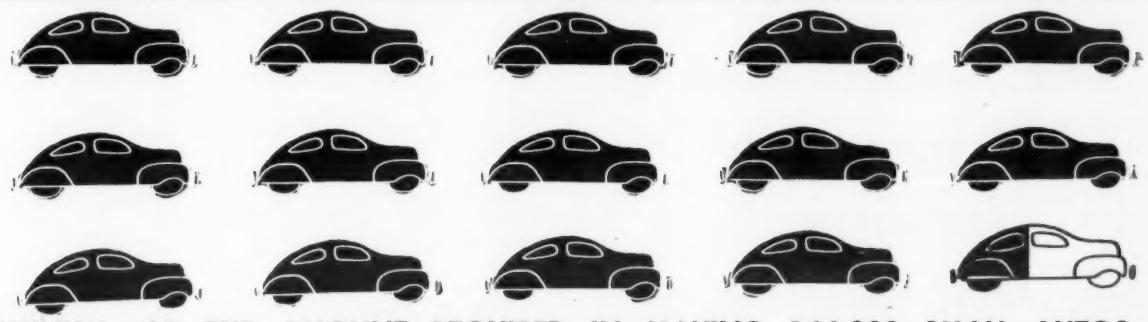
What these materials mean in terms of making passenger automobiles

Each symbol represents the amount of that particular material which is used in the manufacture of 10,000 small automobiles, or about one four-hundredth of the material used in manufacture of automobiles in 1940.

ABOUT THREE TEN-THOUSANDTHS OF U. S. CONSUMPTION OF TIN, OR THE AMOUNT OF TIN REQUIRED IN MAKING 14,000 SMALL AUTOMOBILES.

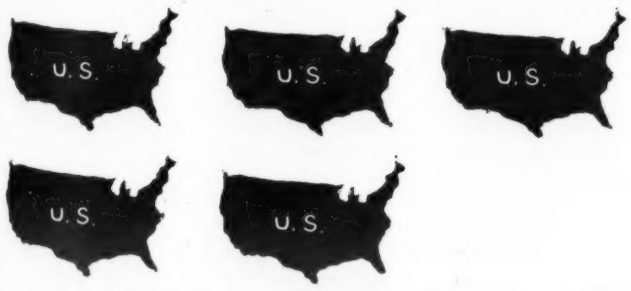
HIP· TH S ABOUT ONE FIVE-THOUSANDTH OF U. S. CONSUMPTION OF ZINC, OR THE AMOUNT OF ZINC REQUIRED IN MAKING 21,000 SMALL AUTOMOBILES.





TLESHIP. HIS IS ABOUT NINE TEN-THOUSANDTHS OF U. S. CONSUMPTION OF ALUMINUM, OR THE AMOUNT REQUIRED IN MAKING 144,000 SMALL AUTOS.

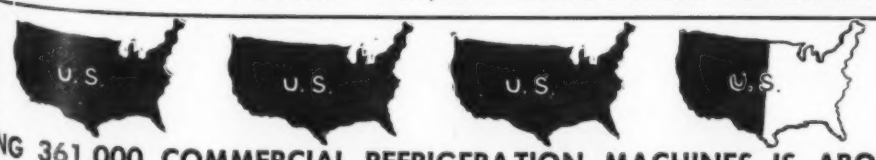
HIS IS OUT TWO FIVE-THOUSANDTHS OF U. S. CONSUMPTION OF RUBBER, OR THE AMOUNT OF RUBBER REQUIRED IN MAKING 7,000 SMALL AUTOMOBILES.



IS IS OUT ONE ONE-THOUSANDTH OF U. S. CONSUMPTION OF COPPER, OR THE AMOUNT OF COPPER REQUIRED IN MAKING 63,000 SMALL AUTOMOBILES.

THIS I BOUT ONE FIVE-THOUSANDTH OF U. S. CONSUMPTION OF STEEL, OR THE AMOUNT OF STEEL REQUIRED IN MAKING 6,000 SMALL AUTOMOBILES.

EL. T IRON USED IN MAKING 361,000 COMMERCIAL REFRIGERATION MACHINES IS 2/1,000 OF U. S. CONSUMPTION, OR ENOUGH FOR 62,000 AUTOS.



IN M NG 361,000 COMMERCIAL REFRIGERATION MACHINES IS ABOUT 7/10,000 OF U. S. CONSUMPTION, OR ENOUGH LEAD FOR ABOUT 34,000 SMALL AUTOS.

allowance may have been made for materials wasted in manufacture. Electric motors are excluded from this data, since these are the product of a distinctly separate industry. Artwork for sketches of material processes furnished by "Newsweek" through the courtesy of Malcolm Muir, publisher. Data on materials in battleships was taken from "Newsweek Reports on National Defense," on U. S. consumption of materials from report of American Bureau of Metal Statistics for 1940 and a report of Automobile Manufacturers Association, and on materials used in small autos from 1941 Ward's Yearbook. Sizes of condensing units: under ⅓hp.—141,000; ⅓ hp.—99,000; ½hp.—82,000; ¾hp.—23,000; 1 hp.—16,000.

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F. M. COCKRELL, *Founder*

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JULY 16, 1941

The Commercial Refrigeration Industry

COMMERCIAL refrigeration is the "middleman" of the refrigeration business, from almost every angle. In size, it is "in between" industrial refrigeration equipment and the household refrigerator. In function, it preserves food from the time it leaves the producers' hands until it is delivered at the door of the consumer.

From an industry standpoint, it is "in between," also. Commercial refrigeration units are manufactured by the makers of heavy-duty industrial equipment; they are also manufactured by the makers of household refrigerators. There is a third group of unit manufacturers which specializes in commercial refrigerating machines. There is another set of manufacturers which make commercial refrigeration products as an adjunct of some entirely different phase of business.

MANY DIFFERENT KINDS & TYPES OF MANUFACTURERS

To give you dramatic examples of this fourth set of manufacturers, one of them specializes in all kinds of coin-operated machines, another in pool tables and bowling balls, one in dairy equipment, and one in farm machinery.

But that is not all. There are two other great, numerous groups to consider. One of these manufactures display cases and cabinets for the storage of foods cooled by mechanical refrigeration units. Another consists of the manufacturers of parts which go into these systems, such as valves, fittings, coils, and refrigerants (chemicals).

COMPETITION IS TERRIFIC

It is a big business and an important business, comprising dozens of manufacturers, big and small, scattered all over the continent from coast-to-coast. But as any outsider could readily surmise from glancing at its vast, sprawling, diverse nature, it is far from cohesive.

Competition is terrific. The distribution system is as thoroughly scrambled as if it were a jigsaw puzzle freshly messed up by two three-year old children. Before attempting to unravel the distribution mess, however, let us take a look at the association phase. There are six interested associations, representative of various segments of the business. They include:

LIST OF ASSOCIATIONS —WHAT THEY REPRESENT

Air Conditioning & Refrigerating Machinery Association (manufacturers of heavy-duty refrigerating and air conditioning apparatus, and commercial condensing units and "packaged" equipment).

National Electrical Manufacturers Association, Refrigeration Division (manufacturers of household refrigerators, commercial condensing units, and "packaged" equipment).

Commercial Refrigerator Manufacturers Association (manufacturers of display cases and cabinets).

Refrigeration Equipment Manufacturers Association (parts and supplies manufacturers, also complete unit manufacturers).

National Frozen Foods Locker Storage Association (operators and manufacturers of locker storage equipment).

A now-being-formed association of "independent" condensing unit manufacturers.

NO OVERALL BODY

There are also a number of manufacturers of various types of products in these categories who belong to no association at all. To complicate the puzzle still further (if you're not dizzy already) several manufacturers belong to two or more of the above groups. In addition, the American Society of Refrigerating Engineers cuts across lines in many directions.

These different associations have so far had little to do with one another. There is no overall body, no liaison committee. That's why much-needed industry standards and industry statistics are non-existent.

This issue of AIR CONDITIONING & REFRIGERATION NEWS, we are proud to say, contains the first complete survey of the industry as a whole, and the first all-industry statistics. This information was collected, compiled, collated, tested, and assayed by the NEWS staff with the aid and assistance of important contacts in every branch of the business.

SEVERAL CHANNELS OF DISTRIBUTION

Now as to distribution. Here is where our loose ends become almost hopelessly untied. We'll start at random, and lay out the pieces for your patient inspection.

There are the "jobbers" for instance. (Most of these firms are organized as the National Refrigeration Supply Jobbers Association, although several important jobbers are not members). They sell everything—parts, supplies, materials, complete units—to almost everyone.

There are the "distributors." These generally represent one line of complete mechanical units and another line of cabinets and cases. They specialize in commercial refrigeration, and sell at retail. Some of these also handle air conditioning equipment.

There are the "dealers," usually household refrigerator dealers who also handle commercial units. This group sells much of the "packaged" units, such as water coolers, beverage coolers, milk coolers, and ice cream cabinets.

There are the factory branches. Some of the biggest case manufacturers buy their condensing units and coils, install them in cabinets at the factory, and sell complete units through their own outlets. Other case manufacturers also assemble.

There are the "national users," who buy refrigeration products direct from the factory for their own use or for redistribution. Examples include grocery chains, bottling works, and dairies. The latter, for instance, purchase most of the industry's output of ice cream cabinets. In turn, they rent or lease or sell these cabinets to the stores which handle their ice cream.

All of the above groups are a bit nebulous, including hybrids and many retail firms which are hard to classify.

HETEROGENEOUS—BUT THEY SERVE AMERICA WELL!

No one type of distribution outlet dominates, any more than one type of manufacturer dominates. And the various groups, both distributive and manufacturing, are about as cohesive as oil, water, mercury, and hydrogen.

Nevertheless, in their independent, bristlingly competitive way, they contrive to serve America's food preservation needs in a more than adequate fashion.

Competition has engendered remarkable engineering improvements, and lower and lower prices which have all redounded to the benefit of the users of these products (who, to complete this surrealistic picture, are also bewilderingly heterogeneous).

WHAT THE INDUSTRY DOES FOR AMERICA

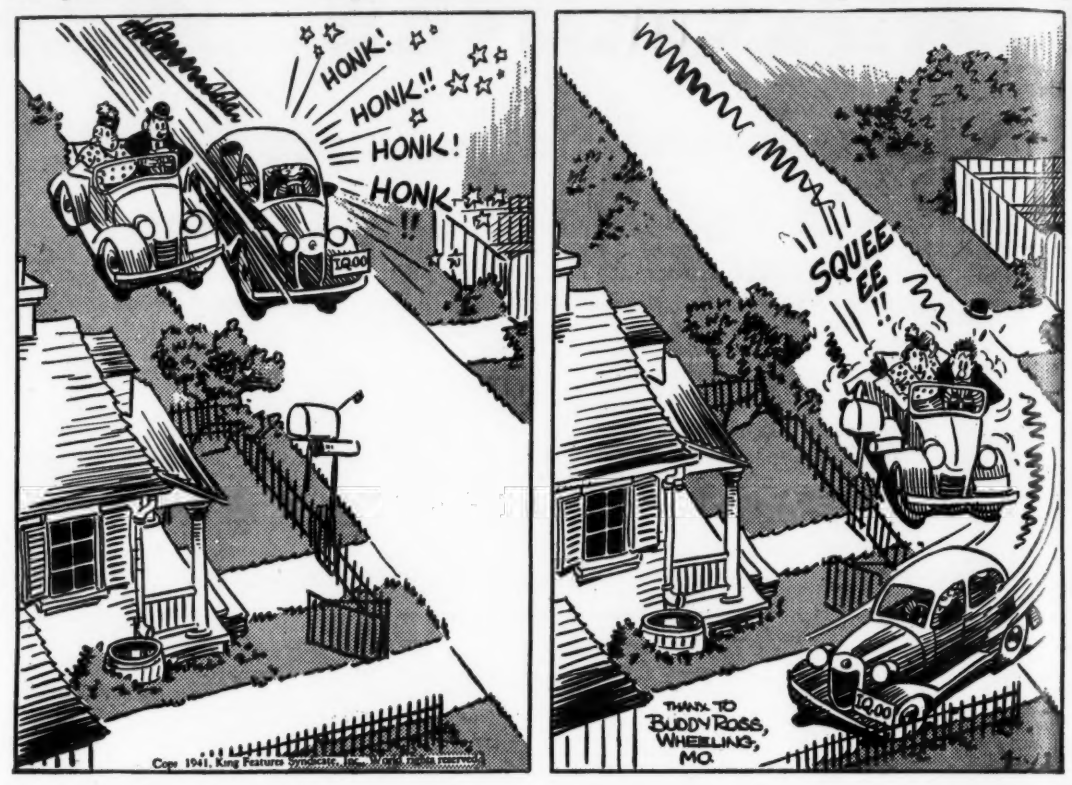
Added up, their contribution to the nation—in terms of protection of health, preservation of food, increased income for farmers, better diets for the people, reduction of wastage, and saving of transportation facilities—is enormous.

Commercial refrigeration has perhaps been most important to the nation's economy in making possible the specialization of agriculture, the utilization of the diverse segments of America's earth in the production of the foods for which each is best fitted.

It has been most important to the nation's consumers as a means of giving the people the foods they want and need 365 days a year, no matter where or when such foods were originally produced.

What industry can match its usefulness to the health, welfare, and economy of the United States of America?

They'll Do It Every Time . . . . . By Jimmie Hatlo



LETTERS

EDITORIAL OUTLINES THE TRUE SITUATION

General Electric Supply Corp.
128 Sixth Ave., S.
Nashville, Tenn.

Editor:

We were so impressed by your editorial in the June 25 issue entitled, "What's Going to Happen to Appliance Dealers?" that we would like to secure some reprints of this article by Mr. Taubeneck, if they are available.

We have been concerned, of course, for months not only about our own appliance business but that of our dealers during 1942, and this editorial certainly outlines the situation as it now exists.

R. A. SHACKLEFORD,
District Manager

SUBSCRIPTIONS POUR IN FROM EUROPE & S.A. . . .

Philips Export Corp.
Madison Ave. at 45th St.
New York, N. Y.

Editor:

We beg you kindly to enter the following subscriptions for AIR CONDITIONING & REFRIGERATION NEWS:

S. A. Philips do Brasil, Refrigeration Dept., Caixa Postal 1489, Rio de Janeiro, Brazil; Philips Orient, S.A., Refrigeration Dept., Rue El Antikhana 28, Cairo, Egypt; Philips Portuguesa, S.A.R.L., Refrigeration Dept., Apartado 144—Lisbon Central, Lisbon, Portugal; Philips Export Corp., Refrigeration Dept., Hotel Roosevelt, 45th and Madison Ave., New York, N. Y.

We further beg you kindly to send to each one of the above addresses, volumes one and two of your Household Refrigeration Service Manual, while in addition, please include with the manuals you are going to send to Rio de Janeiro and Lisbon, one copy of the New Spanish Manual No. HS-1.

A. VERNES, Vice President

WHILE BOMBAY WANTS THE NEW DIRECTORY

The Bombay Garage
Chowpatty, Bombay

Editor:

We note from the AIR CONDITIONING & REFRIGERATION NEWS of March 5, 1941 that the new edition of Refrigeration and Air Conditioning Directory is now available. We shall appreciate receiving a copy at as early a date as possible. If there is a charge for the same, please let us know to enable us to remit the amount.

F. M. CHINOY

Fruits and Vegetables Hold Their Freshness and Vitamin Content If Cooling Is Used

How Refrigeration Preserves Fresh Fruits and Vegetables

ON THE FARM

Storage house refrigeration consists of

1. Air circulation to absorb carbon dioxide exhaled by the oxygen-breathing fruits and vegetables.
2. Uniform, near-freezing temperatures to absorb heat dissipated by the fruits and vegetables and prevent spoilage from bacteria and mold.
3. Close humidity control to prevent excessive drying from too little humidity or mold and hot from too much humidity.

Pre-cooling reduces the temperature rapidly before shipment to

1. Retard ripening.
2. Control fruit and vegetable diseases.
3. Reduce the cost of transit refrigeration.

IN TRANSIT

Refrigerator cars and refrigerated trucks move fresh fruits and vegetables, often long distances, maintaining proper temperatures, humidity, and air circulation to

1. Prevent damage from spoilage in hot weather.
2. Prevent damage from freezing in cold weather.

AT TERMINALS

Large terminals, at railroad stations or in other locations, maintain many rooms under proper refrigerated conditions, with a minimum of handling, for

1. Short periods of storage, pending prompt deliveries to wholesalers.
2. Long term storage of surplus products until they are required in response to the demand.

IN WHOLESALE OR WAREHOUSE STORAGE

In large refrigerated buildings, fruit and vegetables are stored to

1. Supply the regular and emergency demands of retailers.
2. Permit ripening of those fruits which are picked in an immature state.

IN RETAIL STORES

Refrigerated display cases or refrigerated rooms keep fruits and vegetables crisp and fresh by providing the proper temperature and humidity conditions to

1. Prevent spoilage and reduce shrinkage, and waste of trimming.
2. Prevent excessive moisture which causes mildew, mushing, rotting, and rusting.
3. Eliminate losses in moving fruits and vegetables, which formerly were kept during the day in open counters, exposed to the heat, and were transferred to "cold" quarters each night.
4. Prevent damage from handling by customers, many of whom lose the desire to handle the products when they can readily see their quality through glass display cases.

FRESH FRUITS AND VEGETABLES

Refrigeration affords the one way to maintain the original, nourishing freshness of fruits and vegetables from the farm to the table.

The number of refrigerated storages built on fruit and vegetable farms has increased with amazing rapidity within the past 10 years and there also has been a notable growing of commercial storages in cities.

At many railroad stations, fruit and vegetable terminals are maintained to handle perishables in transit. Fruits and vegetables lead in importance in shipments in refrigerator cars. Wholesalers operate large refrigerated buildings where fruit and vegetables are kept crisp and fresh at the proper temperatures pending deliveries to retailers. Fruits picked green are ripened in wholesale houses.

Retail store operators have a new appreciation of the value of cold rooms. In place of a few display cases or an occasional small refrigerator, many retailers now have a series of refrigerated rooms in the basements supplementing display cases.

The tremendous growth of food and vegetable storages is attributed not only to the direct dollars-and-cents savings, but also to the elimination of considerable hauling and handling.

Fresh fruits held in storage under commercial refrigeration are: Apples, avocados, blackberries, cantaloupes, cherries, cranberries, currants, dates, figs, gooseberries, grapes, grapefruit, melons, oranges, peaches, pears, pineapples, plums, raspberries, and strawberries.

Fresh vegetables held in storage are: Artichokes, asparagus, beans, beets, Brussels sprouts, broccoli, cabbage, carrots, cauliflower, celery, corn, cucumbers, eggplant, endive, lettuce, mushrooms, okra, peas, peppers, potatoes, radishes, rhubarb, sauerkraut, spinach, sweet potatoes, and tomatoes.

Refrigeration is not only of great importance in preventing the loss of vegetables by spoiling and loss of flavor and sweetness, but also in conserving the vitamin content. In many cases a rapid loss of this vitamin begins almost immediately after harvest; farmers should cool vegetables before they haul them to market. If refrigeration is applied continuously beginning immediately after harvest, it is possible to transport vegetables such as green peas long distances and deliver them to the consumer without great loss of essential vitamins.

1. FARM STORAGES

Wonderfully effective is the cold storage of today on the farm, developed by the addition of refrigerating machinery. The cost of refrigeration is moving progressively downward and refrigerating units are being built in smaller sizes so that every farmer can have the refrigerating capacity which meets his needs. In addition, the grower of fruits and vegetables who operates his own storage can pack the fruit in the exact manner desired by the trade and can obtain top prices because his products are cooled most promptly after being picked.

The proper temperature for most fresh fruits and vegetables is near the freezing temperature of water. Low temperatures retard the deterioration which comes about in their life span and delay decay due to bacteria or fungi.

Estimates of the cost of storing fruits and vegetables on the farm averages 10 cents per bushel.

2. PRE-COOLING FOR SHIPMENT

Pre-cooling is the comparatively rapid reduction of the temperature of a commodity before shipment to or below that temperature which it might ultimately attain during transit under conventional refrigeration practices.

Purposes of pre-cooling are (1) to retard ripening, (2) to control diseases, and (3) to reduce the costs of transit refrigeration.

Refrigeration prolongs the life span of fruit and vegetables and throttles plant diseases.

When a fruit or vegetable product is harvested, it is cut off from the source of additional food supply and thenceforth its potential storage life is dependent upon such reserves as it may have stored in its own tissues.

In the case of apples, for example, each day's delay in cooling the fruit from 70° to 32° cuts off 10 days from its potential storage life. If peaches are placed in a closed container without refrigeration at a temperature of 50° they will reach a temperature of 86° in 150 hours.

Many potato growers have found that they could command better prices and cut down shrinkage and spoilage by having truck-mounted refrigeration units run alongside loaded railroad cars and lower the temperature in these cars by "piping in" refrigerated air through canvass tubing. In addition to pre-cooling, refrigeration removes considerable surface water from the potatoes.

3. WHOLESALE STORAGE

Wholesale markets in every city require extensive commercial refrigeration to keep fresh fruits and vegetables from the time they are received from the farm until they are delivered to the retailers. In some cases, chains of retail stores operate their own fruit and vegetable depots which keep the products fresh and crisp until they are required in the retail stores.

The old fashioned system by which the farmer rushed his fruit and vegetables to the nearest city at daybreak and wholesalers scurried about to get them delivered to the stores ahead of the oncoming broiling sun, with consequent waste on every hand, has been abandoned by progressive handlers in favor of commercial refrigeration.

Now the time-of-day element in moving fresh fruits and vegetables is of little consequence. The former difficulties of transporting perishables long distances have been overcome.

Large storage houses keep fruits and vegetables in separate rooms or on separate floors from other products, and they are available as the retailer needs them. The refrigerated rooms are arranged conveniently for handling the fruit and vegetables, separating those to be sent on shortly to the retail stores from those that are to be kept in storage for a longer time.

4. RETAIL STORE REFRIGERATION

Refrigerated display cases keep fruits and vegetables crisp and fresh in retail stores and prevent large losses through spoilage. The fruits and vegetables are delivered to the store, having been kept under proper refrigeration, and the use of refrigerated display cases by retailers solely for fruits and vegetables is one of the newer developments of commercial refrigeration.

Display cases provide cool, moist conditions for keeping the vegetables edible and marketable and provide an attractive setting that appeals to the purchasers.

Spoilage, sorting, and trimming are controlled. Spoilage is reduced to practically nothing. Shrinkage and waste are reduced sharply. Fruits and vegetables are kept fresh for days at a time. Separate storage at night, with consequent moving of the fruits and vegetables, is done away with.

Among the newer developments for retail stores are commercially refrigerated rooms for effective fruit and vegetable display. The customers thus have a full view of all the products in the room and the necessity of bringing large quantities from a separate refrigerated storage room is eliminated.

In the Warehouse and In the Store

This installation in a two-block-long railroad terminal for fruit and vegetable storage illustrates one of the many stages in fresh produce marketing which requires the use of commercial refrigeration equipment.

APPLES AND PEARS

Apples and pears are particularly well adapted to refrigerated storage. Due to their rapid metabolic activity at ordinary temperatures, their commercial life is short, whereas, with refrigeration, their commercial life is lengthened five to six times.

Cold storage investigations have brought about a clearer understanding of the performance of apples and pears under refrigeration. For example, apple scald, which formerly resulted in great losses, can now be controlled readily by packing the fruit in oiled paper and by storing in cold storage immediately after picking.

The period for storage of apples and pears varies according to the variety, growing conditions, and treatment before storing. It may range from two to eight months. Both pears and apples keep best when stored immediately in cold storage. Delays in storage result in rapid ripening and a correspondingly shorter storage period.

Refrigeration and close temperature control are important in the profitable handling of pears for canning. Delay in transit of pears from orchard to cold storage is responsible for much of the loss in fruit. One estimate is that one day's delay causes as much deterioration as 10 days' storage.

BANANAS

One of the most extensive applications of commercial refrigeration is preserving bananas from the time they are picked until time to permit them to ripen for sale. They are picked green as always but instead of ripening now in transit, they are kept under refrigeration for weeks and then permitted to ripen under proper conditions to retain their flavor and nourishing value.

They are held at a higher temperature than most fruits because they may suffer an injury known as chilling which prevents their ripening properly when removed to a suitable temperature and sometimes results in discoloration of the skin.

Even ripe bananas may be kept under refrigeration for a week or 10 days.

Spoilage costs and inability to maintain the desired reserve supply are eliminated by refrigeration. The market for bananas has increased considerably because of refrigeration. They reach warehouses all over the country green and hard. Storage rooms provide the correct refrigeration to ripen them as the demand requires. Sometimes bananas are kept for as long as three weeks before being permitted to ripen.

LEMONS

Lemons may be kept in storage for three or four months in excellent condition. They require storage space of 55 to 58° temperature, 85 to 90% relative humidity, and 0.1 to 0.2% carbon dioxide content.

GRAPEFRUIT

Grapefruit are handled and stored similarly to lemons, with 90 days the maximum storage period.

ASPARAGUS

Unless kept at a relatively low temperature, asparagus loses much of its food value and, therefore, its saleability. If the bunches are placed on damp packing and stored at 32° immediately after cutting, they should keep in good condition three to four weeks.

BEANS

Green beans may be stored for one to three weeks. Lima beans in the pods can be stored for three to four weeks.

BERRIES

Raspberries, blackberries, dewberries, loganberries, and strawberries are not adaptable to long storage but may be kept a week or 10 days.

CAULIFLOWER

Storage of cauliflower requires not only the prevention of decay but the retardation of maturity of the head or curd. With a relatively high humidity to prevent wilting, cauliflower will keep two to three weeks.

CELERY

Under proper storage conditions celery keeps from two to four months in good marketable condition. Celery is particularly subject to watery soft rot.

CORN

Corn loses its sugar content rapidly and thus much of its flavor and should be cooled quickly. Corn may be kept in saleable condition in storage one to four weeks.

LETTUCE AND ENDIVE

If in good condition when stored, lettuce and endive will keep two to three weeks.

MELONS

Watermelons will keep one to three weeks. Honey Dew melons will keep one to three weeks. Immature melons may be stored at low temperatures and ripened later.

NUTS

Nuts are often stored from one production season to the next, without rancidity, decay, or insect infestation. Shelled peanuts will deteriorate in warm weather unless kept in cold storage.

PEAS

Peas will keep one to three weeks.

ROOT CROPS

Carrots, beets, parsnips, horseradish, and turnips may be stored for three to five months.

TOMATOES

Ripe tomtaoes may be kept a week or 10 days. Unripe tomatoes will ripen slowly but may be kept two to six weeks.

Fresh Meats For All the People Is Possible Only By Use of Refrigeration

Most Meat Products Kept Under Reduced Temperature From Time Animal Is Killed

How Refrigeration Preserves Fresh Meat

IN PACKING PLANTS

Refrigeration is applied constantly in numerous ways from the time the animals are slaughtered through all the steps in processing and preservation, by control of temperature, humidity, and air motion.

1. Heat from freshly killed carcasses is removed in chilling rooms to make the meat firm, to prevent discoloration, and to prevent spoilage.
2. Tenderizing increases the palatibility, particularly juiciness and tenderness, notably in the poorer cuts.
3. Various curing and processing methods carried on under refrigeration produce numerous types and varieties of meat products.
4. Refrigerated cooler storage controls shrinkage, discoloration, and spoilage by mold and bacteria.
5. Frozen storage keeps surpluses for use when needed.

IN TRANSIT

Refrigerator cars and refrigerated trucks transport meat from packing plants to processing plants or distribution outlets and surplus storage quarters.

IN RETAIL MARKETS

Refrigeration in every retail market

1. Prevents spoilage by inhibiting the growth of bacteria and mold.
2. Keeps the meat firm, eliminating the waste of trimming and loss of weight through drying.
3. Eliminates discoloration and consequent waste.

Preservation of fresh meat—for daily eating by everybody—is a prime job of commercial refrigeration.

Refrigeration begins as soon as the animal is killed, is applied constantly through all the processing and packing plants, is provided in refrigerator cars and refrigerated trucks for transportation from packing centers to distribution outlets, and is maintained in all retail stores until the meat is sold to the consumer.

Uniform refrigeration, constantly applied, is one of the most important factors in providing the consumer with fresh meat products.

As soon as the animal is killed, some preservation means must be administered if the meat is to be eaten at a later date. The means of preservation is partly determined by the period of time between death and consumption.

If the period is to be months or years, the flesh may be cooked and canned or frozen but if the period is a few days or a few weeks, cooling may be used. Meat so preserved is known as fresh meat and is kept by commercial refrigeration.

Beef, fish, mutton, pork, and poultry are the basic meat products kept fresh by refrigeration. Special types and products include bacon, bologna, braunschweiger, corned beef, frankfurters, ham, lamb, liver, lard, salami, sausage, tongue, and veal.

1. PACKING PLANT REFRIGERATION

Meat packing plants require refrigeration not only in great quantities, but of almost every conceivable type and kind.

The meat packing industry is one where all types of applications are found and where all kinds of refrigerating devices are used in the processing, preserving, packaging, and distribution of meat products.

The refrigerating equipment includes all types of high speed compressors, the motors to operate them, compact shell and tube condensers, liquid receivers, and numerous accessories, comprising the "engine room" equipment, and evaporator or "chilling unit" equipment scattered through the plants including brine spray units of all types. Ventilating equipment is secondary only to refrigeration equipment used in packing plants.

It is calculated that 18% of the products produced by the meat packing industry are consumed in hotels, restaurants, and other public eating places and the remainder go to domestic uses.

BEEF AND CHILLING

In killing and dressing plants, beef cattle are "dressed" for market under sanitary conditions and under constant refrigeration.

To assure successful preservation by chilling of sides of beef destined to be shipped for distant consuming markets and in cases where the lapse of time between slaughtering and consumption will extend over as long a period as 30 days, it is necessary to start by taking essential precautions on the killing floor.

Post mortem changes such as rigor mortis takes place after the animal is slaughtered, causing heat and resulting in an increase in the body temperature. Proper cooling of the hot meat is a very important factor in producing final, finished quality.

Experience and constant testing define the proper construction, the correct air circulation, and the correct temperature for cooler operation to achieve the best result.

From each beef carcass, hide, hoofs, head, and viscera are removed; back splitters split the carcass into halves, which are trimmed and washed and "shrouded" with heavy cloth. The large sides of beef are then removed into refrigerated cooler rooms where they are hung to chill. The larger packing plants have long series of chill rooms.

The beef sides must be chilled at a designated rate of speed to give good, firm meat, to hold the color, and to preclude a chance of spoilage. Just the right degree of moisture must be dried out of the beef and the chill must penetrate to the very core.

The conventional chilling room is provided with open spray type overhead brine lofts, either single or double deck, with a capacity of 275 and 450 carcasses respectively.

For loading operations, the initial room temperature is brought down to 22° to 24° and the refrigerating capacity must be enough to prevent it from exceeding 40° during or directly after loading.

Refrigerating systems vary in type and method of operation as the requirements demand. Some form of spray equipment is used in the meat chilling rooms and spray equipment plays an important role in the meat packing industry. Spray equipment, operating with both air and water, does a great service not only in preserving the meat but in maintaining the most sanitary conditions.

Thousands and thousands of brine spray nozzles spray brine solutions and by their antomizing action, set up currents of air which chill the rooms to the proper temperatures. Refrigerator units keep brine vats cold and freezers at the correct temperatures.

Rapid cooling, especially during the first 12 hours, is highly desirable for quick setting and prevention of bone taint, which is characterized by a gassy, putrid smell, and also in restricting the growth of bacteria while the beef is still warm and moist.

Loss of bloom is usually caused by sweating and is likely to occur with fluctuating temperatures and humidities, which are prevented by refrigeration. The distribution of water is caused by the process of rigor. The muscle, which is gummy immediately after slaughter, gradually loosens, becomes moist and free liquid can be readily extracted from it.

MEAT PACKING INDUSTRY 1939

Number of plants....	1,516
Wage and salary earners	137,623
Total wages and salaries	$202,183,000
Number of animals slaughtered	86,665,000
Value of products....	$2,650,000,000

Source: U. S. Bureau of the Census.

POULTRY INDUSTRY—1940

Eggs sold: 30,000,000,000 @ 17.9¢ per dozen, or $447,500,000.00.

Chickens sold: 403,000,000 @ 53.4¢ each, or $215,202,000.00.

Source: U. S. Department of Agriculture, Agricultural Marketing Service.

CANNED MEAT

Processing of canned meats—one of the major functions of the packing plants—provides ready-to-eat meat and lightens the housewives' duties.

The fresh meat is kept under constant refrigeration. Years of experience have taught the packers the temperature to maintain in order that the meat may be thoroughly chilled, and that all fresh meat holds its bloom and freshness.

DRIED BEEF

Fresh carcasses properly chilled and boned are used for beef hams and the curing and drying techniques are dependent upon refrigeration.

Carcasses are chilled for two to five days, the hams and shanks are cured separately and all curing operations are carried on in temperature controlled rooms which vary only 2° from high to low. The control of temperature is one of the major factors in producing satisfactory results.

The beef hams coming from the smoke houses are hung for 48 hours in a special hanging room, also temperature controlled, during which period the hams cool off and become firm. The dried beef is then transferred to storage rooms which are temperature and humidity controlled.

MEAT LOAF

Meat loaf, composed of various mixtures of beef, pork, veal, chicken, and other materials to form more than two dozen different products, is prepared and protected by refrigeration constantly.

Experts select the cuts, they are graded, put through a grinder, chopped, spices are added, and in some cases put through a mixer, and in every case are put into paper or cloth molds for cooking. After the cooking is completed, the loaves are taken to a refrigerated cooler where they are allowed to "firm up" before packaging for consumer use.

PORK SAUSAGE

Pork sausage consists of carefully graded pork pieces of various sizes, derived from many pork cuts in the process of reducing a hog carcass to fresh pork products. All hog cutting and parts grading are done in refrigerated rooms.

In some cases, sausage is manufactured at the same plant where the killing is done, and in other cases, the raw material has to be transported, sometimes for considerable distances, from the killing plant to the sausage plant. In the latter case, the selected pork pieces are placed in rooms where the temperatures are of the specific degrees for periods up to 12 hours. This is to insure a thorough chilling before packing.

The pieces are packed in barrels or drums and are put directly into refrigerator cars or trucks which have been pre-chilled prior to loading. Proper temperature levels are maintained in transit.

Meat Storage In the Butcher Shop

Every retail store which sells any volume of meats has a market cooler similar to this in which meat is kept under refrigeration to prevent spoilage by mold and bacteria, to stop sweating, sliming, and shrinkage.

BACON

Bacon is skilfully cured, brought to perfection in its own rich juices, then hickory-smoked under stopwatch control. Bacon is not frozen but the packing room is kept from 32° to 35°. The bacon retains its natural color, there is less loss from shrinkage, the fat does not separate from the lean, and slices do not break when folded into packages.

2. MEAT STORAGE REFRIGERATION

After chilling and tenderizing, the fresh meat is placed in refrigerated cooler storage to control shrinkage (loss of weght) and to prevent loss of color and spoilage by mold and bacteria.

Storage rooms are of various types and sizes and are used both for storage of cuts of meat and entire or half carcasses. It is the vast, chilly storage rooms, where rows and rows of fresh, firm carcasses are hung, in spotless cleanliness, in the meat packing plants that amaze and delight visitors and give them an idea of the immensity of the meat industry.

COLD STORAGE WAREHOUSES

(1,481 in operation in 1939)
Holding, on June 1, 1941, such food stocks as

Meat Products	
Beef (lbs.)	77,501,000
Pork (lbs.)	794,582,000
Other meats (lbs.)	80,844,000
Lard (lbs.)	353,737,000
Poultry (lbs.)	87,427,000
Eggs (cases)	9,699,000
Dairy Products	
Butter (lbs.)	56,359,000
Cheese (lbs.)	119,628,000
Frozen Fruits (lbs.).....	89,983,000
Frozen Vegetables (lbs.)..	43,320,000

Source: U. S. Department of Agriculture, Agricultural Marketing Service.

The customary limits of cooler storage temperatures are 32° to 45°. Permissible storage periods for small meat cuts range from two to 5.5 days without trimming or discolored surfaces, depending on the temperature and humidity. Permissible storage periods are somewhat longer for larger cuts but freezing is required for longer storage.

Commercial refrigeration controls three of the four factors upon which depend the loss of weight or shrinkage of meat: Humidity, air motion, and temperature. The fourth factor, ratio of external surface to weight, is largely tied up with humidity, as the shrinkage is determined mostly by the relative dryness of the surrounding air and the outside superficial area per pound of weight.

Shrinkage must be checked not only for economic reasons but also on account of impairment of color, and loss of flavor and tenderness at the surface.

Spoilage in cooler storage is due chiefly either to bacteria or mold with one or the other predominating.

Bacterial spoilage is made evident by a slime, sometimes accompanied by small bubbles, and a taint in both odor and taste. At temperatures above 40°, when both high initial bacterial infection and high humidity are present, the spoilage will generally be bacterial. At temperatures below 38° and high humidities, in the absence of high initial bacterial infection, the spoilage will be due primarily to mold.

Mold deterioration starts when mold is first visible. The surface is at first musty in odor and taste, and later acquires a characteristic moldy flavor and smell.

Prolongation of cooler storage is desirable not only for economic reasons but also to permit "ripening." There is an increase in palatibility, particularly juiciness and tenderness, accompanying longer storage and this improvement is most marked with the poorer cuts of meat.

3. RETAIL STORE REFRIGERATION

The widest use of commercial refrigeration in preventing shrinkage, waste, sweating, sliming, and spoilage of meat by mold and bacteria is in the retail store.

The biggest job is the inhibition of the growth of bacteria and mold not only on the surface but in the meat as well. Bacteria multiplication is held down chiefly by the proper temperature.

Recommended retail store temperatures in degrees Fahrenheit for meats are as follows:

Bacon	36-40
Beef	38-42
Bologna	36-40
Corned Beef	36-40
Chicken	35-40
Hams	36-40
Lamb	36-38
Liver	36-38
Lard	40-45
Mutton	34-42
Pork	36-40
Poultry	29-32
Sausage	36-40
Tongue	45-50
Veal	36-40

The secondary function of temperature is to keep the meat firm, which is desirable for two reasons:

If the meat is firm it is easier to cut into steaks, roasts, or chops without the pieces having ragged edges and consequently losing sales appeal.

Lack of firmness in meats contribute to weight loss through drying. The higher the temperature, the greater the weight loss.

Weight and moisture losses are reduced substantially through maintenance of relative humidity. Steaks or roasts lose weight more rapidly than a side or hind quarter because the heavy fat exterior of the latter protects the muscles and tissues.

Refrigeration eliminates discoloration and thus does away with the waste of trimming, especially of end pieces.

Financially, refrigeration enables the retailer to save money by making greater purchases at smaller rates, enables stores to carry larger varieties of meats and display them more temptingly, and reduce overhead and operating expenses.

Milk and Dairy Products, Most Nutritive of Foods, Must Have Refrigeration

How Refrigeration Preserves Milk And Dairy Products

ON THE FARM

Refrigeration is used to drop the temperature of the milk to at least 50° F. as soon as possible after milking, in order to

1. Retard bacterial growth.
2. Prevent fermentation, thus eliminating the possibility of objectionable odors and souring, and insuring "sweet" milk with good flavor.

IN DAIRY FARM BOTTLING PLANTS

Refrigeration is employed to

1. Cool the milk after drawing.
2. Cool the milk after pasteurization.
3. Store bottled milk after delivery.

IN MILK RECEIVING STATIONS

Milk is received from farms which do not pasteurize and bottle their own milk, and is cooled preparatory to shipping to a pasteurization and bottling plant.

IN MARKET MILK PLANTS

Milk is received from farmers or from receiving stations, and then is processed and held for delivery. Refrigeration is required to

1. Cool the milk after pasteurization.
2. Keep the milk cool until it is delivered.

IN CREAMERIES

Refrigeration is used to

1. Cool cream after pasteurization.
2. Maintain proper temperatures during the ripening process.
3. Cool water for washing.
4. Store butter and other milk products.

IN TRANSIT

Refrigerated and insulated railroad cars and trucks are used to keep milk and milk products from spoiling during shipment.

IN RETAIL STORES

Commercial refrigeration coolers, cabinets, and display cases of varied types are used to hold milk and dairy products at proper temperatures.

Importance of milk as a food product is attested to by the fact that now—for the first time since the Revolutionary War, incidentally—fresh milk has been included as an integral part of the daily rations of U. S. soldiers engaged in field maneuvers.

More than 350,000 quarts of fresh milk per day will be consumed by the maneuver forces, plus the new trainees in cantonments, it is reported. In addition to fluid milk requirements, over 20 tons of butter, more than 10 tons of cheese, and large quantities of other dairy products are consumed daily by the nation's armed forces.

This means that more than 1,000,000 quarts of milk from American farms are required every day for pasteurization and distribution or processing into dairy products for the army.

ARMY TESTIMONY

Army officials believe that fresh milk provides health-giving and body-building values of the highest order. Lt. Col. Paul P. Logan of the subsistence office of the War Department recently stated:

"All of us in subsistence work are acutely aware of the value of milk and dairy products in the ration. We know that milk solids are indispensable and that milk is the nearest perfect food."

Further testimonial as to the importance of milk as a factor in human development comes from Dr. E. V. McCollum of Johns Hopkins University, who says:

"The people who have achieved, who have become large, strong, vigorous people, who have reduced their infant mortality, who have the best trades in the world, who have an appreciation for art, literature, and music, who are progressive in science and in every activity of the human intellect, are the people who have used liberal amounts of milk and its products."

Milk is by far the most important agricultural product in the United States, furnishing as it does one-fourth of the total farm income. Over 3,000,000 farmers sell milk. About 100 billion lbs. of milk a year are required to meet the country's needs.

COW TO CONSUMER

Adequate facilities for the proper cooling of milk from cow to consumer are of utmost importance to the health and welfare of the American public, and the use of mechanical refrigeration equipment is by far the most satisfactory means of accomplishing this cooling.

Principal advantages of mechanical refrigeration as compared with the use of ice have been outlined by Prof. Kenneth M. Renner, head of the department of dairy manufactures at Texas Technological college, as follows:

"1. Automatic in its action.

"2. Insurance of a more constant temperature.

"3. Less danger of contaminating the milk.

"4. Actually cheaper to operate in most instances over a period of years."

Agricultural engineers, members of various dairy industry regulatory bodies, and faculty members and specialists connected with the agricultural departments of various colleges and universities are practically unanimous in their echoing of the need for more and more application of mechanical refrigerating equipment to the particular problems of the dairy industry.

W. D. Tiedeman, chief of the New York State Bureau of Milk Sanitation says: "Prompt cooling of milk and storing at a temperature of 50° F. or lower are very important factors in the production of high quality milk. Tests have shown that air cooling of milk in winter is unreliable, and experience has shown that it is unsatisfactory."

D. G. Ebinger, extension specialist of the department of agricultural engineering at Michigan State college, declares that: "Electric coolers provide an economical means for the quick cooling and storage of milk at low temperature. The high quality of milk produced under sanitary conditions can be maintained with the aid of an electric milk cooler."

H. H. Musselman, head of the department of agricultural engineering at Michigan State college, expresses this opinion: "Considering the advantages which mechanical cooling offers, it is reasonable to expect an increase in the use of this kind of equipment. Higher standards of sanitation and safety to health also call for the use of more efficient cooling equipment."

25,000 FIRMS INVOLVED

There are approximately 25,000 firms engaged in the milk and milk products industry in this country, each of which uses and needs a wide variety of mechanical refrigeration equipment A breakdown of these firms follows—(overlapping of some classifications accounts for discrepancy between the total of these figures and the estimated total of 25,000 companies):

Milk dealers	13,549
Ice cream manufacturers	6,736
Butter manufacturers	5,896
Cheese manufacturers	4,168
Condensed, evaporated, and dry milk manufacturers	1,629

Cooling of milk and dairy products is necessary at many stages in the production and marketing process—on the farm, in dairy farm bottling plants, at milk receiving stations, at market milk plants, and at creameries. In addition to this, there is the need of providing proper refrigeration for the milk and its by-products while in transit, and while being held at retail sales points.

There are three methods of cooling milk on the farm for bulk delivery—bulk cooling in cans set in cold water; quick cooling over a surface cooler as fast as drawn, then storage in cans in cold water; and cooling over a surface cooler, then dry storage in a cooler of the walk-in type.

Purpose of this on-the-farm cooling is to drop the temperature of the milk to at least 50° F. or below as soon after milking as possible to insure "sweet" milk with good flavor.

Milk fresh from the cow has a temperature of almost 100° F., and at this temperature bacteria multiply and may soon spoil the milk. These bacteria start to multiply as soon as the milk is drawn from the cow, and continue this action until temperature of the milk has been lowered to at least 50° F.

QUICK COOLING IMPORTANT

The quicker this cooling can be accomplished, the less the production of bacteria will be. When ordinary well or spring water is used for this cooling, from 2 to 4 hours may be required before the milk reaches the proper temperature; mechanical refrigeration equipment makes it possible to accomplish this same degree of cooling in 45 minutes to 1 hour.

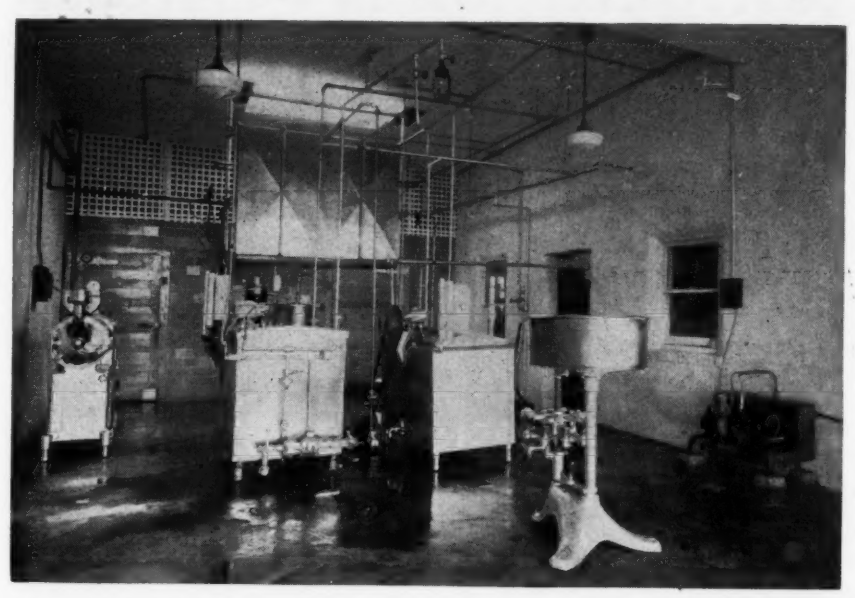
Bacteria, like vegetation, grow rapidly in warm temperatures and slowly in cold temperatures. Under favorable temperatures bacteria double in number every 20 minutes. Unless bacterial growth is checked, undesirable fermentation takes place in the milk, causing objectionable flavors, bad odors, or souring.

Effect of temperature upon the growth of bacteria is well illustrated by the following table, taken from a U. S. Department of Agriculture Bulletin, which shows comparative rates of bacteria increase at 68° and 50° F.

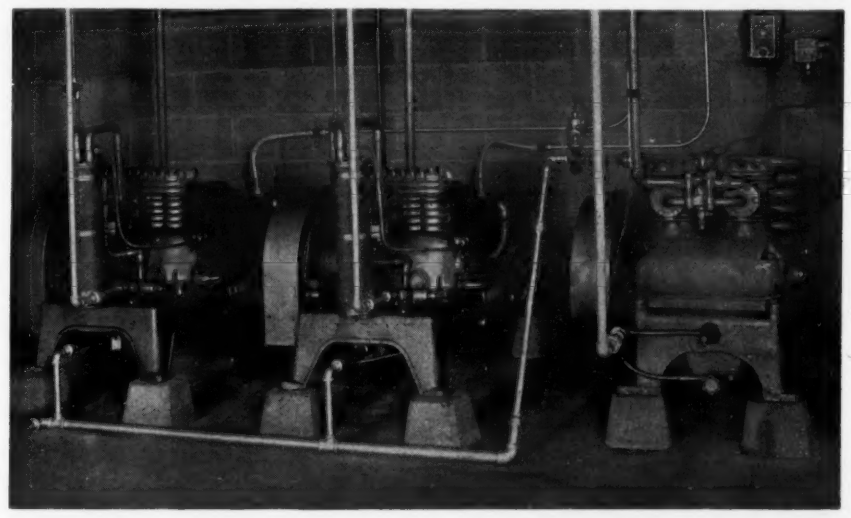
Because of poor refrigeration facilities and consequent slow rate of cooling, it is estimated that $40,000,000 worth of milk is lost each year in the United States

Farm cooling of milk is accomplished by one of two methods. One way is by placing the milk in cans and then setting these cans in a wet-storage cabinet in which water chilled to about 32° F. by refrigerant coils is circulated around the cans.

Refrigeration at Work In a Modern Dairy



Aerating room of a typical small dairy. Refrigeration is needed for the aerating process, as well as in most of the other steps through which dairy products pass. Small refrigerating machine is mounted at the right.



These small, low pressure refrigerating machines used for the dairy and ice cream plant pictured above represent modern trend in refrigerating machines for smaller plants in this field.

The other means is by use of an aerator or surface cooler in which the milk runs in a thin sheet over a plate or series of tubes or coils through which either chilled water or a direct expansion refrigerant is circulated.

The aerator method is the quickest, milk being cooled immediately to approximately 40° F. Milk placed in cans in a wet-storage cabinet is cooled down below 50° F. in about an hour or less.

For storage of cans of farm cooled milk, either a wet-storage cabinet of the type decribed or a regular walk-in cooler is most commonly used. Sometimes combination units with wet-storage facilities for milk and dry storage for food products are employed.

In dairy farm bottling plants, the usual practice is to cool night milk as fast as drawn, store it in a pasteurizing tank overnight, add the morning milk, and then pasteurize the whole batch by the low-temperature holding method. Refrigeration is required for cooling the night milk, as well as for cooling the entire lot after pasteurization. Dry refrigerated storage space also must be provided for the bottled milk until it is taken out for delivery.

Two recognized methods of pasteurizing are employed. In the holding process, milk is heated to 142 to 145° F. and held at that temperature for 30 minutes before cooling. The other process consists of heating the milk quickly to 160° F., holding it there for not less than 15 seconds, and then cooling it rapidly. In either case the need for adequate refrigeration equipment is evident.

Milk receiving stations receive and cool milk preparatory to shipping to a city plant, where the pasteurizing and bottling are conducted. Refrigeration requirements of these stations usually are best satisfied with some type of direct expansion system.

Usual procedure at these stations is to receive milk in the forenoon, beginning in the early morning. It is dumped into a receiving vat, which serves as a balancing vat, but ordinarily is cooled as fast as it is received. It is shipped in bulk, either in insulated tank trucks, insulated railway tank cars, or in 10-gallon cans in refrigerated cars or trucks.

A market milk plant is one that is equipped for processing, handling, and storing market milk. Such plants are located in cities and receive their supply of milk by trucks or trains either direct from farmers or from receiving stations. Incoming shipments usually are received sometime during the forenoon. The milk is pasteurized, cooled, bottled, and stored overnight for delivery to customers the next morning. Processing begins as soon as the milk is received, and usually requires three to five hours in the smaller plants and six to 10 hours in the larger ones.

A creamery is a plant having for its main object the manufacture of butter, but many are equipped to manufacture other products as well, and thus are able to handle surplus milk and cream to best advantage. Refrigeration is employed in cooling the cream after pasteurization, maintaining temperatures during the ripening process, and cooling water for washing and for storing the butter.

In regard to the proper refrigeration protection for milk during delivery, Mr. Renner, whose address before the University of Texas Food Preservation Conference was quoted previously, points out that "the use of ice bunkers, ice sacks, and direct icing methods is wasteful and messy," and expresses the opinion that some sort of mechanical unit refrigerating an insulated truck body is the answer to this problem.

A wide variety of such refrigerated and insulated delivery trucks now are available as standard equipment from many manufacturers, and specially designed units of practically any type can be obtained upon special order.

A wide variety of commercial refrigeration cabinets are used to keep milk and milk products at proper storage temperatures in retail dairy stores and markets. This equipment ranges all the way from large walk-in coolers to smaller storage cabinets and display cases, some designed expressly for dairy products.

How Proper Temperatures Retard Bacteria Growth

Milk Temperature	Beginning	End of 6 Hours	End of 12 Hours	End of 24 Hours	End of 48 Hours
68° F.	10	17	242	61,280	3,574,990
50° F.	10	12	15	41	62

Refrigeration Is A 'Must' Item In Many Parts of The Defense Program

Plays a Vital Role In Supplying Army & Navy With Proper Foods

Both on land and on sea the armed forces of the United States depend to a great extent upon the services of various types of mechanical refrigeration equipment to "keep them going" at top-notch efficiency.

One of the most important of the functions performed by mechanical refrigeration is, of course, the preservation of food for soldiers and sailors.

Only recently the War Department announced a program for assuring adequate refrigeration facilities for soldiers' food. Prime point of this program was the conversion to mechanical refrigeration of nearly 12,000 ice boxes now in use in Army encampments throughout the country.

This program was instituted as the result of an extensive study of the ice and refrigeration requirements of Army posts, camps, and stations; of the availability of ice from commercial sources; and of the prices which would have to be paid for commercial ice.

The War Department's own official announcement of this program stated that this move would result in a marked reduction in ice requirements, in much more satisfactory refrigeration, and in a reduction in the amount of food lost through spoilage.

Also included in this program is the construction of eight ice plants, to provide the ice necessary for table use and other purposes. These plants, which, of course, are made possible only by the use of commercial refrigeration equipment, will be located at posts where commercial ice is not available in sufficient quantities or at a reasonable enough price.

Under the present plan, ice plants are to be constructed at the following stations: Fort Benning, Ga.; Camp Davis, N. C.; Camp Forrest, Tenn.; Camp Polk, La.; Camp Shelby, Miss.; Fort Knox, Ky.; Fort Leonard Wood, Mo.; and Fort Huachuca, Ariz.

One of the first big Army cantonments in the country to use mechanical refrigeration on such a large scale was Fort Blanding, Fla. A total of 593 commercial units of this type were ordered for this post last fall, to serve the 65,000 troops which were to be stationed there.

Other similar installations of commercial refrigeration equipment in Army establishments have followed at frequent intervals in recent months, as the number and size of these establishments have steadily increased.

In addition to these individual commercial units, big cold storage warehouses, each capable of holding enough food to feed 12,500 men for four days, or a city the size of Cairo, Ill. or Atchison, Kan., for a similar period of time—have been erected at a number of Army camps.

Besides solving the problem of food preservation, commercial refrigeration equipment has been installed at various Army posts for a wide variety of applications. At Albrook Field, Army air base in the Panama Canal Zone, for instance, commercial refrigeration is being used to cool two clothing storage rooms, a storage room for photographic paper, several film vaults, the equipment repair building, and the engine test building. At Fort Monmouth, N. J. an air conditioning installation was made in the battery testing room, where batteries for signal corps work are checked.

As far as the Navy is concerned, commercial refrigeration equipment finds many uses both at shore stations and on shipboard. At shore stations, the requirements are similar to those of Army posts. On shipboard, however, a number of special technical problems are involved.

Some idea of the amount of refrigeration equipment installed on naval vessels, and the uses to which it is put, was given by Lt. Commander E. I. McQuestin in a talk before Detroit refrigeration men early last year. Here is a condensation of the information offered by Lt. Commander McQuestin:

"Aircraft carriers have three 6-ton units, battleships have three 3-ton units, cruisers have two 3-ton units, destroyers have two 1-ton units, and submarines have one ½-ton unit.

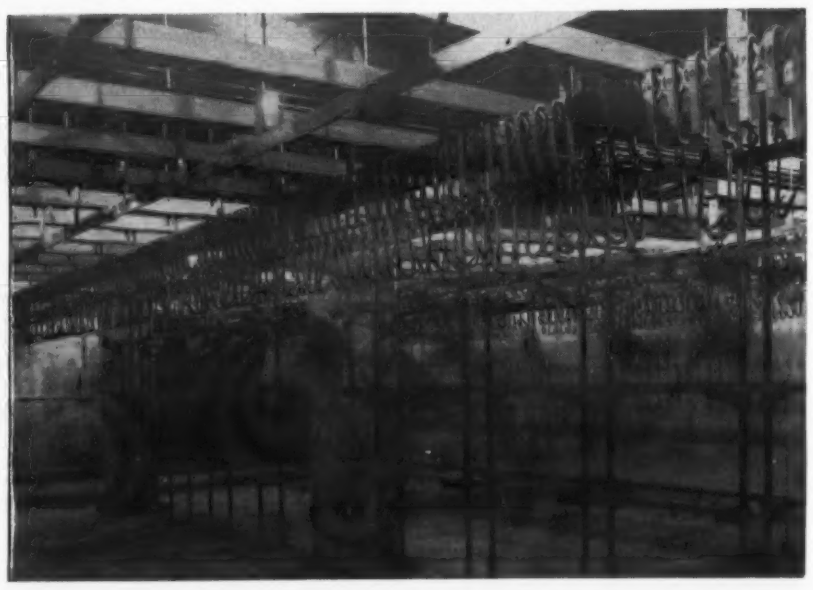
"Primary purpose of any of this refrigeration equipment is for food preservation and habitability. Occassionally cooling is used for other, more specialized purposes, such as cooling ammunition magazines and sick bays. In addition to the big systems which refrigerate the ship's storerooms (a battleship often carries a 30-day supply of provisions for its crew of 1,200 men) there are smaller installations which provide the refrigeration for the ship's soda fountain and similar service facilities. Each officer's mess has its own refrigerator, as does every captain, but these are regular commercial cases of the type that might be found in any restaurant.

"Greatest use of naval refrigeration, of course, is on supply ships such as the Arctic. This ship has 168,000 cu. ft. of refrigerated storage space. These cargo carriers are the 'lifeline' of the Navy while at sea, sometimes carrying as much as a 30-day supply of beef, for instance, for the whole fleet.

"Transfer of provisions from the cargo carriers to the combat ships is made during early morning hours, when the air is coolest. Time involved in this operation is not over one hour, so the food is not kept out of refrigerated quarters long enough to suffer any deterioration.

"On practically all combat ships, parallel installations are used so as to minimize the danger of complete shutdown of refrigeration. In other words, on a heavy cruiser which has two 3-ton machines, one of these machines can and does handle the entire load. The other is used as an auxiliary. In actual operating practice, however, the machines are usually run on alternating weeks, thus offering time for cleaning or repair during the off weeks."

No Torture Chamber---an Army Camp Cold Room



This meat storage plant at one Army camp typifies the way refrigeration is used to properly preserve the food which feeds America's fighting forces.

Cooling Is Essential In Many Kinds of Arms Producing Operations

Today commercial refrigeration is furnishing the essential temperatures required for the precise production of tools, instruments, metals, oils, airplanes, tanks, guns, ships, parts of all kinds, explosives, medical equipment, photographs, chemicals, rubber, fabrics, and many other items most essential to the national defense program.

Not only in the production of defense materials but in their testing, and in many cases, in their use, storage, or repair, commercial refrigeration is necessary. New applications of commercial refrigeration are being developed constantly. Maintenance of artificial cooling at specific points is essential throughout the defense program.

The production of airplanes, machine guns, and hundreds of instruments in control apparatus demands an unprecedented degree of accuracy in the machine shops. Final grinding operations on thousands of intricate parts require that the work be carried forward at a uniform temperature, and the only practical method of accomplishing this purpose is to use commercial refrigeration to maintain a uniform temperature of the coolant oil which is sprayed over the grinding wheels in contact with the work.

Structural alloys used in defense work, such as duralumin and others containing aluminum must be subjected to low temperatures to make them workable. The metals must be as soft as possible, and in the case of duralumin, softness is obtained by preventing aging and automatic hardening. The alloys are cooled to 32° and stored at this temperature until they are used.

The anodic treatment of aluminum to prevent corrosion and numerous other plating operations require control of temperature for uniform results. Water or brine cooled by commercial refrigeration must be circulated in the treating or plating tanks to remove the heat generated by electrical currents.

Modern heat treating methods demand elaborate heat treating operations and because annealing temperatures of many metals are so high that oxidation occurs in ordinary air, the atmosphere of these furnaces must be made up of inert gases usually produced by the partial combustion of natural gas. These products of combustion must be thoroughly dehydrated to eliminate the oxygen in the water, and again commercial refrigeration is the last step in condensing out excess moisture to insure "bright" annealing.

Airplane engines are being tested in ground laboratories where refrigeration simulates the low temperatures at all altitudes including the stratosphere. Engineers determine the engines' power and flow of fuel at various speeds.

The carburetor air is cooled down sometimes as far as 67° below zero and the gasoline supply is cooled to zero. Army requirements call for flexibility of operation for varying load conditions. For air cooled engines, the cooling air is provided.

Engine starters also are tested under conditions imposed by low temperatures and the proper carburetor jet sizes are determined.

Low temperature cooling cabinets have been developed by the refrigeration industry within the past year to control tolerances in industrial processes and to hold rivets used in making airplanes at below zero degrees until they are ready for assembly.

The units are portable and may be moved from one assembly line to another. At below zero temperatures rivets shrink and when warmed up after the assembly, they expand and fill the holes tightly and securely.

Low temperature cabinets also are used in testing bimetallic strips under varied temperature conditions for aircraft motors, machine guns, and other equipment. One part is heated, the other cooled, and when both are returned to normal temperatures, there is an absolutely tight contact.

Similarly, liquid carbon dioxide refrigeration is used to obtain a perfect bonding of a rod and a sleeve. The rod is immersed in the liquid, contracting enough to allow the sleeve to pass over. Returning to normal temperature, the rod expands sufficiently to form a tight bond with the sleeve.

Many precision instruments are called upon to function accurately at varying temperature ranges.

Refrigeration is used to keep at proper temperatures calibrated gauges which are used to measure parts whose expansion or contraction tion due to temperature changes is greater than specified tolerances.

Cold storage doors are being used to seal low temperature rooms in which large guns are tested so engineers may ascertain how they will operate during the winter.

Explosives, a major requirement for national defense, need refrigerated low temperatures for manufacturing processes, for testing performances, and for storage until needed.

Nitroglycerine is made by the nitrification of glycerol in a mixture of one part of nitric acid and two parts of sulphuric acid at a low temperature. The two acids are mixed and placed in a tank into which glycerol is sprayed. Temperature of the ingredients is kept below 75° F. and the resultant washing is at about 50° F.

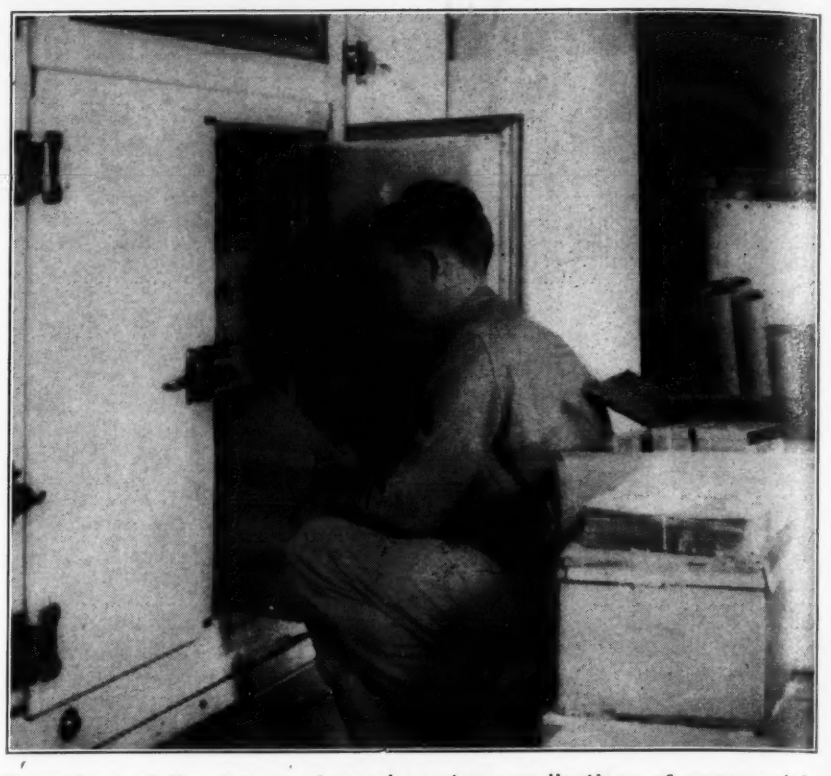
Crystallization of ammonium nitrate is effected simply by cooling without the danger of decomposition or explosion at higher temperatures. Rapid cooling and drying at low temperatures prevent caking of ammonium nitrate crystals.

Fuse loading plants use cool air to dry black powder and permit proper blending in manufacture. A high humidity is necessary to prevent explosions from static electricity.

Dinitroglycol, which is used in making explosives, is stored under low temperatures to prevent deterioration.

For maintaining the quality of powder during experiments, low temperature rooms are used on proving grounds. Powder magazines employ refrigeration to some extent.

Another Way In Which Army Uses Cooling



Exemplary of the dozens of supplementary applications of commercial refrigeration equipment in Army life is this storage cabinet for film used by Air Corps photographers.

Refrigerative Therapy Finds Increased Use In Medical Circles

Commercial refrigeration is not only indispensable to the every-day operation of every hospital today but has made possible experimental and research work that already is of incalculable benefit to mankind.

The turn to mechanical refrigeration by medical scientists in the last few years is one of the milestones in the increasingly effective battle against disease and death. And the future possibilities and probabilities are limitless.

The most baffling disease—cancer—is being retarded.

The most terrible habit—drug addiction—is being cured in a few days.

Insanity—an affliction for centuries which has shown a horrifying increase in this century—is being overcome.

The "human refrigeration" treatment of cancer has been found effective in at least one fundamental respect—relief of pain. Of 100 cases reported by one physician who is among the leaders in the research, human refrigeration relieved pain in all but two cases.

It is possible to reduce the temperature to 82°, without ill effects. No patient has taken cold or pneumonia. Cancer cells cooled to 90° or lower will continue to live but will not grow.

With a new method of induced hibernation, hopeless drug addicts are being cured.

Treatment of disease by refrigeration is being extended to other ailments, particularly tuberculosis, where tissues heal while malignant germ life is dormant, and insanity.

Popularly called "frozen sleep," the treatment for insanity consist in lowering the victim's body temperature from 5° to 10° below normal for a number of hours, but the patient is neither "frozen" or "asleep." The body does not freeze and the patient sleeps and wakes much the same as a normal person.

Emergency blood transfusions, which save many persons' lives in the face of death, are made possible immediately by commercial refrigeration.

In "blood bank" refrigerators, samples of the four types of human blood are kept on hand at an exact temperature so that they are always ready for transfusion. The blood must be kept at a temperature that does not vary ½°.

One of the newer uses of refrigeration is in surgery in cases where the patient's condition will not permit the use of an anaesthetic. In such cases the arm or leg is frozen to deaden the pain during amputation.

Vaccines, arsenicals, serums, and other medicinal products are stored at constant temperatures under commercial refrigeration in hospitals.

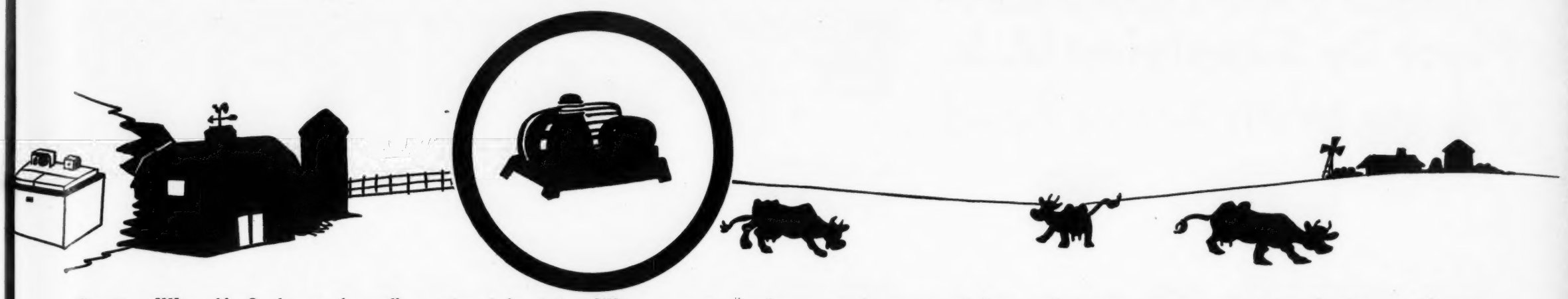
Laboratories maintain cold storage rooms which are in reality oversize "medicine chests." Refrigeration not only maintains a constant temperature to assure that products will be kept in their most effective condition but also prevents excessive moisture penetration.

In the development of X-ray pictures, medical "photographers" lean heavily upon refrigeration.

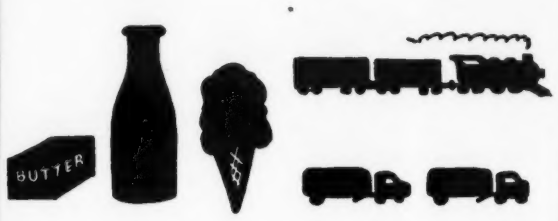
Less striking than the medical uses of refrigeration outlined in the preceding paragraphs but affecting the welfare of every hospital patient is the use of commercial refrigeration in preserving hospital food. The greatest attention must be paid to the food of hospital patients as it is generally one of the factors considered in their treatment.

Perishable food such as meats and fruits and vegetables must be kept at the proper temperatures, and often special diets are ordered which must be kept at specified temperatures. Ice cream and milk cabinets, quick-freezing cabinets, and ice cube makers are other examples of commercial refrigeration in hospitals in addition to the standard reach-in refrigerators and walk-in coolers which preserve the standard items of food.

How Refrigeration Protects Milk from Cow to Consumer



On 5 million U. S. farms, the milk produced by 25 million cows is the largest single source of farm cash income, amounts to twice the income of cotton

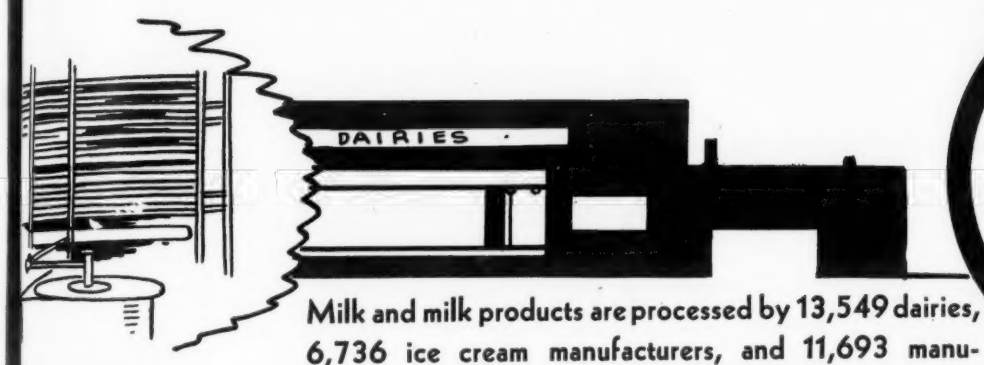


Milk and milk products are sent to dairies by refrigerated trucks and trains

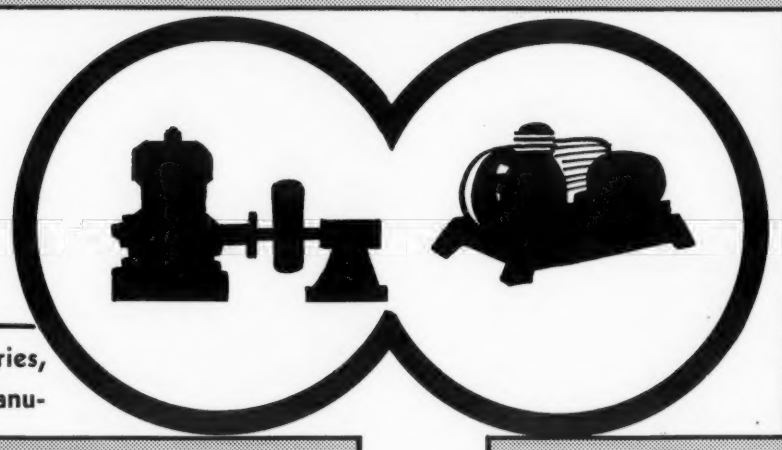
MILK PRODUCTION GROWTH

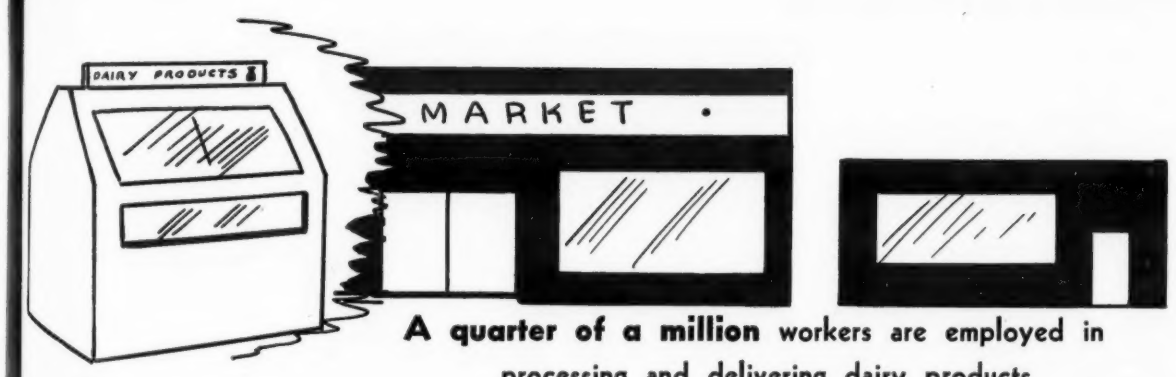
(In Billions Of Quarts)

1889	20
1899	29
1909	30
1919	31
1929	46
1931	48
1933	49
1935	47
1937	48
1939	50

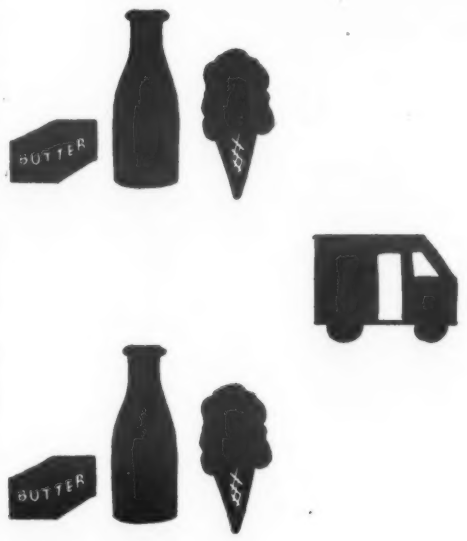


Milk and milk products are processed by 13,549 dairies, 6,736 ice cream manufacturers, and 11,693 manufacturers of other dairy products



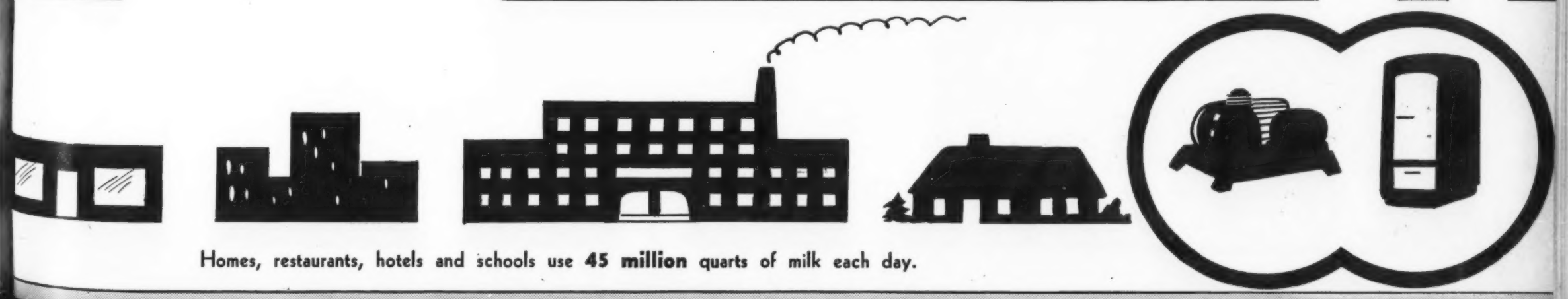


A quarter of a million workers are employed in processing and delivering dairy products



HOW THE U. S. MILK SUPPLY IS USED
(1937—1939 AVERAGE)

	Millions of Quarts	
FLUID MILK AND CREAM FOR CITIES AND VILLAGES	15,157	OR 29.9%
CREAMERY BUTTER	16,056	OR 31.6%
ICE CREAM	1,554	OR 3.1%
CHEESE	3,184	OR 6.3%
CANNED MILK, DRY MILK, ETC.	2,366	OR 4.7%
MILK USED ON FARMS	5,941	OR 11.7%
FED TO STOCK ON FARMS	1,346	OR 2.6%
FARM BUTTER	4,683	OR 9.2%
MISCELLANEOUS USES	476	OR 0.9%



Homes, restaurants, hotels and schools use **45 million** quarts of milk each day.

Quick Frozen Foods Gain Place By Supplying U. S. People With Better Food

Quick-frozen food has been characterized as the food industry's solution to the problem of preserving food in a fresh state and delivering it to the consumer the year around, at a reasonable cost, packaged, and prepared ready for use.

From the commercial standpoint, frozen food can be divided into the following three general classes:

1. Quick-frozen, or carton pack, for institutional and retail distribution—fruits, vegetables, meats, poultry, fish, and other seafoods prepared ready for cooking or serving, packaged at the factory, transported and stored at approximately 0° F., and delivered in frozen form and in the original package to the institutional or retail consumer.

2. Cold-pack, or frozen-bulk-pack, for processors—fruits frozen and packed in large containers (450-lb. barrels down to and including 30-lb. tins, boxes, lugs, and cartons) mainly for the preserves, ice cream, and baked goods industries.

3. Cold-storage, or frozen-storage—meats, poultry, and seafood which have been frozen for transportation and storage only, which are not necessarily prepared and packaged ready for use, and which are usually sold to the consumer thawed and as fresh products.

Most reliable estimates obtainable, however, place the total quick-frozen pack as follows: 1937—145 million lbs.; 1938—250 million lbs.; 1939—350 million lbs. Frozen food production curves have continued their upward trend since that time, but no reasonably accurate figures are as yet available.

The packer of frozen fruits and vegetables has three general outlets for his products: processors who use the frozen products for converting into other food forms; institutions; and the retail trade.

Processors constitute the most important of these outlets from a quantity standpoint, but the bulk of the production is taken by comparatively few buyers who purchase in large quantities and whose consumption varies with the demand for their product.

The prospective institutional and retail markets are equal to the present consumption of fresh, canned, and other processed foods.

Five general types of quick-freezing systems are now in general use. As in other heat-transfer processes, all of these methods are based on the principle of radiation, conduction, or convection.

The five freezing methods mentioned are as follows:

1. Still air. The product, either packaged or loose, is placed in low temperature rooms in trays which are stacked with spaces between them.

2. Forced air circulation. Tunnels or cabinet freezers through which cold air blasts are forced are employed for freezing.

3. Contact. The product, either packaged or loose in trays, is placed in direct contact with refrigerated surfaces.

4. Spray. Packaged or loose products are passed through a refrigerated liquid spray.

5. Immersion. Product, either loose or packaged in sealed tin cans, is submerged in a liquid.

Normal channel of distribution of frozen foods is from packer to wholesaler to retailer to consumer.

The packer freezes the food products and then stores them until they are shipped to the wholesalers. The wholesalers, in turn, store the foods either in refrigerated warehouses of their own or in public cold storage warehouses until they are delivered to the retailer. The retailer stores the foods in low temperature cabinets of one type or another until they are sold to the ultimate consumer, who either uses them within a few hours or places them in the low temperature compartment of the household refrigerator, or—if the family uses large quantities of frozen food—perhaps in a special low temperature unit designed exclusively for home storage of frozen foods.

Food authorities seem generally agreed that in regard to nutritive value frozen foods excel canned foods and compare favorably with fresh foods in many instances.

Vitamin C, which according to Dr. Faith Fenton of Cornell University, "May well be taken as a criterion of quality and nutritive value of vegetables," also is retained to a very great degree in frozen foods.

Says Dr. Fenton, "If it [vitamin C] is retained, so also are other attributes known as quality—that is, color, aroma, flavor, texture, and nutrients. It cannot be stored in the body, so it must be furnished each day and perhaps each meal.

"In one of our studies, we analyzed fresh and quick-frozen peas, and cooked fresh and cooked frozen peas. The vitamin C content per given weight of the cooked fresh and cooked frozen peas was practically the same."

Five Divisions of a Refrigerated Locker Storage Plant

(1) The chill room, where carcasses are hung to lose their animal heat. (2) Processing room, where plant butcher cuts meat into the desired cuts for the renter. Note equipment, sink, and freezer room door. (3) The locker room, where the patrons' food is stored. "Cold plates" which supply refrigeration are shown near the ceiling. (4) The freezer room, which is held at temperatures below zero. The individually wrapped packages are laid upon shelves (in this case made of cooling coils) where they are frozen solid. This quick-freezing process is the secret of retaining vitamin content, moisture, taste, and tenderness of meats. (5) Mechanical refrigeration units which furnish the cold effect in the various rooms of the locker plant.

Refrigerated Locker Plants Offer Decentralized Storage Facilities

Importance of the use of frozen food during wartime conditions and periods of national defense was brought out sharply by A. E. Stevens, vice president of Birds Eye Frosted Foods Sales Corp., in an address before the second annual conference of the Institute of Food Technologists.

"Great Britain's defense, up to now, has been possible largely because it preserved and retained foods," Mr. Stevens declared. Emphasizing Britain's foresight in enlarging storage facilities for vast quantities of quick-frozen foods, Mr. Stevens explained that three years ago Britain had virtually no storage space capable of holding 0° F. temperatures, but today has 50 such warehouses, 10 of them government owned, and is daily speeding the construction of more warehouses.

One of the ways in which quick-frozen foods may become a factor in the present emergency existing in the United States, Mr. Stevens pointed out, is through the fact that these foods require less transportation facilities and less storage space than the so-called fresh foods.

"This is important," he asserted, "as storage space near terminals diminishes daily and transportation priorities become likely. One carload of quick-frozen peas is equal to 10 carloads of fresh peas in the pods. A carload of unshelled peas contains about 6,600 lbs. of edible peas—there are over 60,000 lbs. of edible peas in a carload of the quick-frozen variety.

"This means that one carload of quick-frozen peas frees about nine other railroad cars for some other use, an important consideration when and if transportation priorities are enforced."

Recognition of the value of quick-frozen foods by the U. S. Army is contained in the fact that frozen beef was successfully used to feed the 65,000 troops which engaged in the recent field maneuvers in Tennessee.

For use in this test, all bones were removed from the meat, and the meat was frozen at temperatures ranging from —30 to —40° F. Delivered under refrigeration, the meat took 24 hours to thaw.

A saving of 60% in storage space was one aim achieved, and it also was found that the meat, delivered, was cheaper by approximately one cent per pound than under other methods.

One of the fastest growing industries in America today—and one which is in a position to assume a vital role in the nation's defense effort—is that of frozen food locker storage.

Today there are approximately 4,000 frozen food locker storage plants operating in the United States.

The installations have exerted a vast influence on the eating habits and privileges of rural and city folk throughout the country. They have raised the standard of living for thousands.

In general, the locker plant system of food processing and distribution, if properly organized and well operated, may be beneficial to its patrons chiefly in two ways: first, it may encourage greater production and use of home-grown foodstuffs, which in turn should improve and stabilize the diets of these families, particularly in periods of depression; second, it may lower the cost of distribution and hence increase the consumption of some foods.

What is frozen food locker storage?

Original purpose of the refrigerated food locker storage plant was to provide freezer-storage facilities for the storage of food products in rural areas, and to provide precooling and processing service for meats farm-killed or killed at a slaughterhouse connected with the plant.

Many other items besides meat are now being stored—fruits, vegetables, butter, eggs, etc. There has been considerable effort made to use refrigerated locker storages to boost the distribution of commercially packed quick-frozen foods.

Refrigerated space in the average frozen food locker storage plant consists of a chill room held at 32 to 40° F., an aging room held at about 34° F., a quick-freeze room held at —10 to 0° F. (depending upon the type of refrigeration used), and a locker room held at 0 to 10° F.

In the normal course of procedure, freshly slaughtered meat put through the locker plant goes first to the chill room for removal of body heat, and then to the aging room, where it is hung for a while to improve its tenderness and flavor. After being taken from the aging room, the meat is cut up according to the patron's directions, wrapped, and transferred to the quick-freeze room, where it is frozen. The frozen packages of meat are then placed in the patron's locker.

Fruits and vegetables are processed in a variety of ways, depending upon the type of product and the taste of the patron, and are then quick-frozen and stored in the locker just as is the meat.

The locker operators derive income from the food processing charges and from any brokerage business or retail sales activity they may conduct, as well as from rental of the lockers themselves. Patrons benefit from fresh food in or out of season at money-saving prices.

Role of locker plants in the defense program could be four-fold, according to a program drawn up by the locker industry for presentation to the National Defense Council:

1. Prevention of inferior standards of living in the event of war or emergency, due to a lack of accepted peace-time rations.

2. Prevention of "profiteering" during such emergencies.

3. Maintenance of the nation's morale by maintenance of the normal food level and dietary balance. With sufficient storage facilities, it is pointed out, there would be no necessity for "meatless days," for example, as was the case during 1917 and 1918. The theory is that people denied their regular orange juice each morning might get grouchy and lose their fighting spirit along with their vitamins.

4. Wide location and quick availability of food, in the event of invasion.

Because an estimated 70% of the existing locker plants can triple their present capacity without any change in present equipment, locker industry leaders are suggesting that these plants be granted government subsidies in the form of rental guarantees to cover cost of constructing additional storage space.

Restaurants Will Have an Increasing Need For This

A restaurant chef selects some quick-frozen foods from the special low temperature compartment of a restaurant refrigerator. Institutions and restaurants are big users of frozen foods, and special low temperature equipment has been devised to hold such products until they are used.

May Nema Sales of All Commercial Machines Tops 35,000 Units

The following report of commercial refrigerating equipment sales for May, 1941 was made to the Commercial Refrigeration Section of the National Electrical Manufacturers Association (Nema) by the following 15 companies: Baker Ice Machine Co., Inc., Brunner Mfg. Co., Carrier Corp., Crosley Corp., Frigidaire Div. General Motors Corp., General Electric Co., Gibson Electric Refrigerator Co., Kelvinator Div. Nash-Kelvinator Corp., Merchant & Evans Co., Norge Div. Borg-Warner Corp., Servel, Inc., Universal Cooler Corp. (out as of March 31, 1941), Vilter Mfg. Co., Westinghouse Electric & Mfg. Co., and York Ice Machinery Corp.

SALES FOR MAY, 1941	Domestic Quantity	Domestic Value	Canadian Quantity	Canadian Value	Other Foreign Quantity	Other Foreign Value	Total World Quantity	Total World Value
1. Bottle Water Coolers—Complete	819	$ 60,380	....	....	31	$ 2,217	850	$ 62,597
2. Pressure Water Coolers—Complete	5,492	573,221	19	$ 1,754	77	8,213	5,588	583,188
3. Water Coolers—Low Side Only	131	6,988	1	60	2	93	134	7,141
4. Ice Cream Cabinets—Complete	6,944	1,067,556	549	95,382	54	8,131	7,547	1,171,069
5. Ice Cream Holding Cabinets Only (Remote)	304	46,914	6	1,230	2	304	312	48,448
6. Bottle Beverage Coolers—Complete	10,752	985,978	71	6,492	111	14,480	10,934	1,006,950
7. Beverage Coolers (No High Sides)	18	2,395	....	....	1	43	19	2,438
8. Milk Coolers—Complete	3	301	....	....	....	....	3	301
9. Milk Cooling Cabinets (No High Sides)	....	....	....	....	....	....	....	....
10. Commercial Evaporators—Not Reported Above (Including Cold Diffusers, Brine, and Other Spray Evaporators, Etc.)	2,132	128,767	566	21,701	486	27,827	3,184	178,295
11. Condensing Units Less Than ⅓ Hp	2,940	145,303	191	8,732	354	16,942	3,485	170,977
12. Condensing Units—⅓ Hp	3,483	217,823	94	5,933	236	15,182	3,813	238,938
13. Condensing Units—½ Hp	2,462	209,614	94	8,163	148	12,628	2,704	230,405
14. Condensing Units—¾ Hp	1,198	132,723	54	6,014	82	8,813	1,334	147,550
15. Condensing Units—1 Hp	662	90,874	32	4,407	71	9,666	765	104,947
16. Condensing Units—1½ Hp	330	57,711	15	2,676	82	13,800	427	74,187
17. Condensing Units—2 Hp	178	36,726	8	1,664	39	7,618	225	46,008
18. Condensing Units—3 Hp	120	31,697	3	588	44	8,965	167	41,250
19. Condensing Units—5 Hp	75	31,187	5	1,826	8	3,108	88	36,121
20. Condensing Units—7½ Hp	17	12,438	....	....	3	1,837	20	14,275
21. Condensing Units—10 Hp	13*	11,090*	....	....	1	594	14	11,684
22. Condensing Units—15 Hp	12	7,513	....	....	....	....	12	7,513
23. Condensing Units—20 Hp	9	9,427	....	....	1	1,752	10	11,179
24. Condensing Units—25 Hp	1*	2,107*	....	....	....	....	1	2,107
25. Condensing Units—30 Hp	15	26,700	....	....	....	....	15	26,700
26. Condensing Units—40 Hp	3	4,802	....	....	....	....	3	4,802
27. Condensing Units—50 Hp	....	....	....	....	....	....	....	....
28. Total—All Condensing Units (11 to 27)	11,518	1,027,735	496	40,003	1,069	100,905	13,083	1,168,643
29a. Condensers—Sold Separately Shell & Coil or Shell & Tube	4	548	....	....	....	....	4	548
29b. Evaporative Type	1	270	....	....	1	625	2	895
30. Total—All Commercial Refrigeration	....	$3,901,053	....	$166,622	....	$162,838	....	$4,230,513

*Includes sales and credits.

'Serviceman's Notebook' Table on Heat Loads In Water Cooling Systems Is Explained

Calle Dr. Jose C. Barbosa No. 7
San Juan, Puerto Rico

Editor:

Referring to page 10 of your number dated June 4th, and particularly to the heading "The Service Man's Notebook" by Henry Kronke, I would like to have an explanation of the table shown under above heading.

I understand that to reduce the temperature of one gallon of water 40° F. we will require 341.9 B.t.u./hr. while according to the table we will only require 408.7 B.t.u./hr. to reduce the temperature of 9 gallons 40° F.

It is possible that I have not interpreted the table correctly and I would like to be enlightened on the subject.

CARLOS R. ROSSI

Answer: In the body of the table is shown the result of 8.34 multiplied by 1 to 99. In the first horizontal column 8.34 is multiplied by 0-1-2-3-4-5-6-7-8-9, in the second column by 10-11-12-13-14-15-16-17-18-19. In other words, the round figures 0-90 in the first vertical row are complemented by the figures 0-9 in the top horizontal row, so that the result for any number from 1-99 may be found.

In the heading over the table the term "Degree-Gallon" is used, by which is meant the degree Fahrenheit temperature reduction multiplied by the number of gallons of water. It makes no difference in the result whether we want to cool five gallons 15° F. or 15 gallons 5° F. or 75 gallons 1° F. or one gallon 75° F., the result will be the same as for 75 degree-gallons, which is found in the table by going horizontally from 70 to under the 5 on top of the table, giving us 625.5 B.t.u. If we want to cool 50 gallons 15° F. we have 750 degree-gallons and can still use the table by moving the decimal point, thus 6,255.0 B.t.u.

The figure 408.7, which you question, does not represent the B.t.u. required to cool nine gallons 40° F., but 49 degree-gallons, or to be more specific, seven gallons cooled 7° F. or one gallon cooled 49° F. or 49 gallons cooled 1° F.

We want to mention that the time element B.t.u. per hr., which you use is intentionally omitted.

Re-Tinning of Refrigerator Shelves Is Found Generally Cheaper When Done Outside

Unless the volume of work is on a really large scale, rebuilders of household electric refrigerators generally figure that it is cheaper to have electric refrigerator shelves re-tinned outside their plant than to set up their own re-tinning operation.

In the re-tinning operation there are three baths necessary. These baths must be large enough to permit dipping of the largest sized refrigerator shelf.

The first bath contains a solution of muriatic acid for the purpose of removing dirt and dust from the shelves. The shelves are then rinsed in cold water and dipped in a bath of hot tin. They are then dipped in another bath of tin, the surface of which is covered by a thin layer of palm oil. Purpose of this bath is to smooth out the tin.

Estimated costs for a plant doing about 3,000 lbs. of re-tinning monthly is said to be between $1,500 and $2,000.

One large household electric refrigerator rebuilding plant gets its re-tinning done at a local plant at a price ranging between 8 cents and 10 cents per pound. This plant's requirements are abount 5,000 lbs. a month (a refrigerator shelf weighs around 3 lbs. and thus will cost about 30 cents for the re-tinning).

Claims Water Conditioner Will Clean Clogging Condenser System

PITTSBURGH—Recirculated condenser cooling systems can be quickly freed of algae growth, rust, scale, and corrosion by use of its new water conditioner, claims Water Treatment Co. of America. Known as "Baerite 21-A," the conditioner is an organic formula which becomes active only in the presence of the offending factors, without affecting pumps, gaskets, or packing, it is said.

The conditioning agent is a highly concentrated liquid which is placed in cooling systems at the ratio of 1 gallon to 12,500 gallons of water. The manufacturer supplies a testing kit and testing solutions to determine requirements for proper conditioning of the water.

A special formula has proved successful, the company claims, in cleansing and stopping corrosion in brine systems using sodium, calcium, and magnesium brine.

'Stuckert Equipment Co.' Is Firm's New Name

LOUISVILLE, Ky. — To better identify himself with his refrigeration business, A. E. Stuckert has changed the name Louisville Refrigeration Co. to that of Stuckert Equipment Co.

Here's How To Design a System For Proper Cooling of Beer

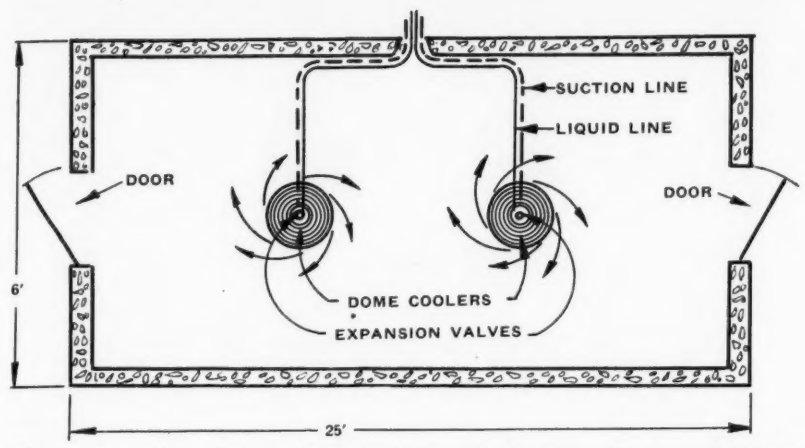


Fig. 1—Location of dome type cooling units in beer storage refrigerator is shown in this diagram.

* * *

Editor's Note: This is one of a series of articles discussing methods of estimating load requirements, selecting equipment, and making the proper kind of an installation for specific types of commercial refrigeration installations. Sam Moncher, author of these articles, is a refrigeration engineer who has done considerable work in estimating for commercial installations.

By Sam Moncher

Most important sales item for a bar and grill is draft beer, the proper dispensing of which is an exact science. The amount of beer which goes to waste because of improper dispensing equipment is 20-30% of the total brewery shipments.

While the maintenance of proper temperatures is but one of the factors which makes for efficient beer dispensing, the design of the complete system usually falls into the hands of the refrigerating engineer.

The actual spoilage of beer due to fermentation is not difficult to overcome, inasmuch as draft beer will keep well at temperatures below 50°. What is a problem, however, is the tendency of beer to foam or be flat when not drawn at the proper pressure, which for American beers is the pressure necessary to maintain a solubility of 2.5 volumes of carbon dioxide per volume of beer.

American tastes also dictate that beer be served at a temperature of about 40°, wherefore, disregarding heat gains and pressure drop in beer lines, a pressure of approximately 12 lbs. will have to be maintained at all times in a keg kept at 40°. As the temperature rises, the solubility of the carbon dioxide in beer decreases, and the pressure must be raised to offset this.

In beer dispensing establishments of the larger size, the stock of beer kegs is of necessity located at some distance from the dispensing unit, thereby requiring the use of a pipe line between the two. The ideal beer dispensing system is one in which the beer temperature remains constant from the time it leaves the keg until it leaves the tap. This involves a method of refrigerating the beer lines, and forms the basis of many patented beer dispensing systems which utilize any of the following methods:

(1) Direct expansion of refrigerant
(2) Circulation of cold water
(3) Circulation of cold air.

The installation which we shall discuss, however, will be of the type where no attempt is made to refrigerate the beer in the lines between the keg and dispenser. The lines will be insulated to minimize temperature rise, and the beer will be precooled to 45° in the basement precooler. Thus the dispensing unit will be charged with the task of cooling the beer from a possible maximum of 47° to the desired dispensing temperature of 40°-42°.

In addition to a precooler, and refrigerated dispenser, an ice cube maker and refrigerator for bottled beverages are useful in installations of this type. For convenience, the bottled beverage refrigerator is usually located in back of the bar, with the ice cube maker installed in it.

LOW SIDE EQUIPMENT FOR PRECOOLER

Forced air units are very suitable for beer precooling because of the rapid rate of heat transfer which they provide. For the precooler under consideration, "Dome" type ceiling units are particularly adaptable for they occupy no usable wall

(Concluded on Page 25, Column 1)

Survey Sheet For Bar & Grill Refrigeration

	PRECOOLER	DISPENSER	BACK BAR containing ICE CUBE MAKER
OUTSIDE DIMENSIONS	25′ x 6′ x 8′	4′ x 1′6″ x 2′6″	6′ x 3′ x 3′
INSULATION	3″ Palco Bark	2″ corkboard	3″ corkboard
MAXIMUM AMBIENT TEMPERATURE	80°	85°	85°
REFRIGERATOR TEMPERATURE	45°	33°	40°
PRODUCT LOAD PER 24 HOURS	15 wood half-kegs arriving at 55°		100 lbs. of ice cubes made from water at 70°
PEAK LOAD PER HOUR		50 gal. beer at 47° 2 gal. water at 70°	

Load Calculations

A. HEAT GAIN OF PRECOOLER

Total outside surface = 796 sq. ft.
Cubical content = 840 cu. ft.

	B.t.u./24 hrs.
Insulation loss = 796 x .09 x 35 x 24 =	60,200
Usage loss = 840 x 1.1 x 24 = (see Table 1)	22,200
Product load (containers) = 15 x 65 x .5 x 10 =	4,900
Product load (contents) = 15 x 16 x 8 x .9 x 10 =	17,300
Total load =	**104,600**

Hourly load based on 16 hr. operation = 6,600 B.t.u./hr.

B. HEAT GAIN OF DISPENSER UNDER PEAK CONDITIONS

Outside surface = 58 sq. ft.
Cubical content = 8 cu. ft.

	B.t.u./hr.
Insulation loss = 58 x .11 x 53 =	340
Infiltration loss = 8 x 10 =	80
Product load (beer) = 50 x 8 x .9 x 7 =	2,500
Product load (water) = 2 x 8 x 30 =	480
Total load (peak) =	**3,320**

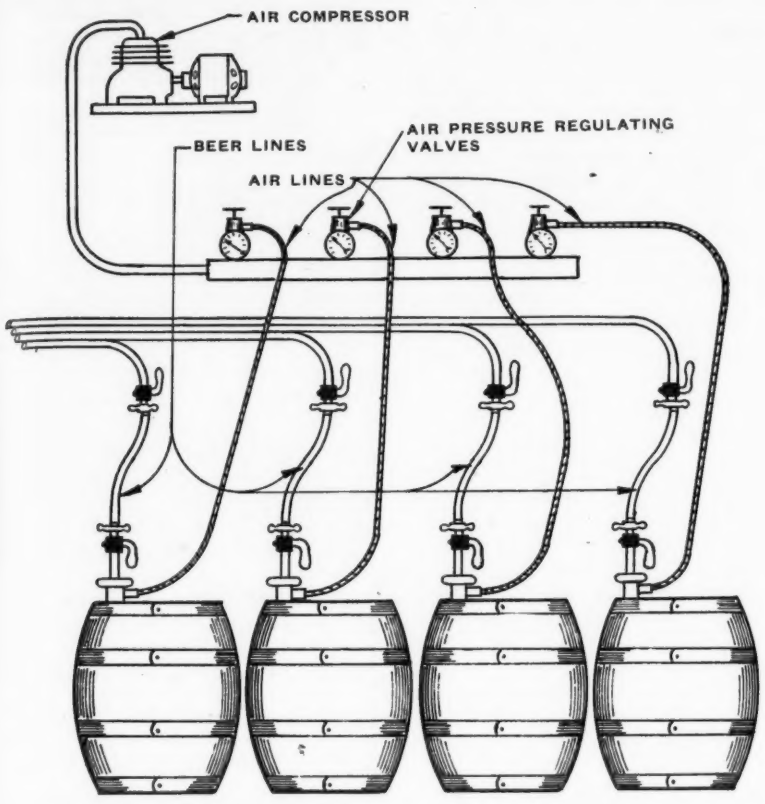
C. HEAT GAIN OF BACK-BAR INCLUDING ICE CUBE MAKER

Outside surface = 90 sq. ft.
Cubical content = 25 cu. ft.

	B.t.u./24 hrs.
Insulation loss = 90 x .09 x 45 x 24 =	8,800
Usage loss = 25 x 8 x 24 = (see Table 2)	4,800
Product load (ice cubes) = (sensible heat) 100 x 38 =	3,800
(latent heat) 100 x 144 =	14,400
Allowance for other products =	5,000
Total load =	**36,800**

Hourly load based on 16 hr. operation = 2,300 B.t.u./hr.

Fig. 3 - Hook-up of Air & Beer Lines To Barrels



This drawing diagrams the hook-up of both air lines and beer lines between the beer barrels and the dispenser.

Suggested Design For Beer System

(Concluded from Page 24, Column 5)

space. (See Fig. 1.) Inasmuch as the refrigerator is so long and narrow, and since units of this type have a maximum air throw of about 15 feet measured across the face of the unit, two units will be necessary, each with a minimum capacity of 3,300 B.t.u. per hour. To prevent drying of the wooden kegs, the temperature difference between air and refrigerant should not exceed 20° F.

LOW SIDE EQUIPMENT FOR DISPENSER

The beer dispenser comes equipped with a water tank containing five coils of block tin tubing, wound spirally 50 feet to the coil (see Fig. 2). A bare pipe refrigeration coil of the basket type, constructed of ⅝-inch copper tubing is to be used to provide the necessary cooling, in conjunction with two air bubblers to agitate the water thereby increasing the effectiveness of the coil.

Under these conditions each lineal foot of ⅝-inch copper tubing will have a heat transfer capacity of approximately 3 B.t.u. per hour per degree temperature difference between refrigerant and water. In order to avoid a freeze-up in the water coil, the temperature of the water bath should never fall below 33° F. At a 20° coil temperature, therefore, the lineal feet of refrigerant coil necessary may be calculated as follows:

$$\frac{3320}{3 \times 13} = 85 \text{ feet.}$$

Many bartenders like to have a certain measure of control over the temperature of the beer they serve, and this may be provided readily by the use of a thermostat and liquid line solenoid valve. (See Fig. 2.) A special thermostat calibrated from 33° to 40° F. is available for work of this type, and will allow a small variation in beer temperature without the fear of freeze-ups.

To prevent a reduction in the heat transfer between refrigerant coil and water bath by excessive ice formation on the coils it is advisable to add sufficient anti-freeze to lower the freezing point of the water to about 25° F. An anti-freeze of the Prestone type is recommended.

LOW SIDE EQUIPMENT FOR BACK BAR

For the back bar, a finned type ice cube maker gives a practical solution to the problem of ice cube manufacture and bottled beverage cooling. Two freezings per day may conveniently be figured on, so that the ice cube maker need have an ice capacity of only 50 pounds, plus a cooling capacity of 1,200 B.t.u. per hour with 20° refrigerant. It is located in the center compartment of the back bar, and is served by its own door.

HIGH SIDE EQUIPMENT SELECTION

The selection of condensing equipment for the precooler and back bar should be made on the basis of 16 hour operation per day, inasmuch as the load is fairly constant throughout this period. For the dispensing unit, however, there is a peak load for about three hours, during which more than half the day's beer is sold. The condensing unit for this piece of equipment, therefore, should be chosen to have an hourly capacity equal to the peak load.

Although many arrangements of condensing units are possible, a very satisfactory set-up will result by using a separate compressor for the beer precooler which operates at a 25° evaporator temperature, and another compressor for both the dispenser and back bar which operates at a 20° suction temperature. The precooler condensing unit will need a capacity of 6,600 B.t.u. per hour at 25° suction temperature (approximately a ¾-hp. unit), while the one manifolded to the other two refrigerators will require 5,600 B.t.u. per hour at 20° suction, or again approximately a ¾-hp. unit.

PRESSURE REGULATING EQUIPMENT

In addition to the pressure required to keep sufficient carbon dioxide dissolved in the beer, pressure is required to lift the beer from the precooler to the dispenser. Assuming a density of 61 lbs. per cu. ft. for beer, the pressure drop per vertical foot of lift will be 61 ÷ 144 = .42 lbs. per sq. in.

There is an additional pressure drop due to the friction of the beer against the walls of the pipe through which it flows, which is a useful pressure drop, however, for it permits the beer to leave the tap at a pressure slightly above atmospheric. Otherwise the beer would rush out of the tap too rapidly and create an abnormal amount of foam.

Fig. 3 shows the hook-up of an air pump to the kegs in the refrigerator, thereby permitting the desired pressure to be maintained by the use of compressed air. An individual pressure control for each keg is advisable, but not necessary. Care must be exercised to prevent foul air or oil slugs from entering the beer kegs and imparting a bad taste.

Table 1 - Usage Factors For Bar Pre-Coolers

Empirical usage factors for beer precoolers, expressed in **B.t.u. per hour per cubic foot** of interior volume, and based on a temperature difference of 30°-40° between ambient temperature and refrigerator.

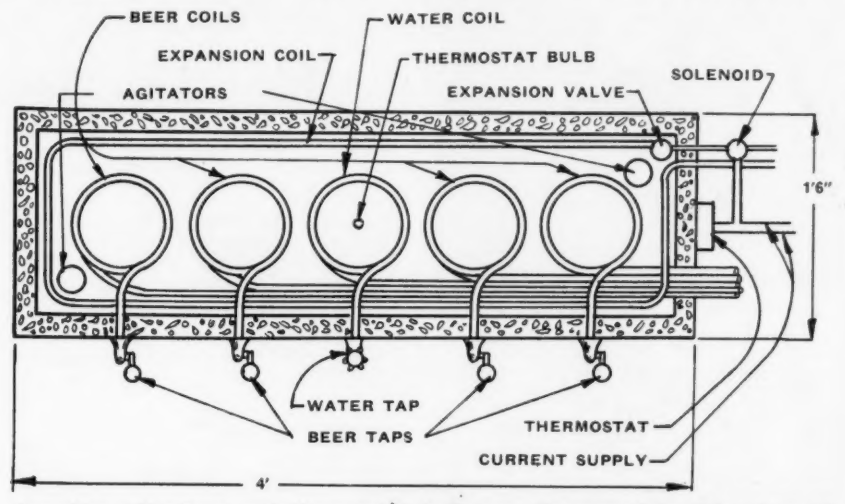
Size	Factor
Under 300 cu. ft.	2.8
300- 500 cu. ft.	1.7
500- 700 cu. ft.	1.4
700-1,000 cu. ft.	1.1
1,000-1,500 cu. ft.	.9

Table 2 - Usage Factors For Refrigerated Back-Bars

Empirical usage factors for back-bars, expressed in **B.t.u. per hour per cubic foot** of interior volume, and based on a temperature difference of 50°-60° between ambient temperature and refrigerator.

Size	Factor
Under 20 cu. ft.	10.0
20-30 cu. ft.	8.0
30-40 cu. ft.	7.5
40-50 cu. ft.	7.0

Fig. 2 - How Beer Dispenser Is Connected



Location of valves and thermostat bulb are diagramed in this view of the beer dispenser. Note also the beer and water coils.

Servicing Ice Cream Cabinets and Other Low Temperature Equipment

By Arch Black and Dean C. Seitz

Editor's Note: This is the eighth instalment of a new section on ice cream cabinet servicing in the series of articles which cover servicing of all types of low temperature refrigeration equipment for use in retail business.

Service Complaints on Low Side Float Systems (Cont.)

COMPLAINT No. 9—Suction line frosts.

Cause No. 1—Leaky float valve.

If a float valve leaks, more refrigerant will be allowed to enter the evaporator than is required. As a result some of this refrigerant which is at a low temperature will overflow into the suction line causing it to frost.

The correction for this trouble has been previously discussed under Complaint No. 1, cause No. 2.

Cause No. 2—Incorrect float valve calibration.

This point has been previously discussed under Complaint No. 4, cause No. 4.

Cause No. 3—Cabinet not level.

If the ice cream cabinet is tipped in the direction parallel to the float, it is possible for refrigerant to flow down the suction tube in the boiler and into the suction line.

The obvious remedy is to set the cabinet level.

COMPLAINT No. 10—Bottles are too warm.

This complaint will only be received on a combination ice cream cabinet in which both ice cream and bottled goods are stored.

Cause No. 1—Bottle cooling compartment overloaded.

The manufacturers of combination cabinets publish the cooling capacity of the bottle storage compartment. If more bottles are placed in the cabinet than the manufacturer claims can be cooled, some of the bottles will be warm.

The obvious remedy is to explain to the customer that he has exceeded the capacity of the cabinet and that he should purchase a separate bottle beverage cooler.

Cause No. 2—Hand valve not open.

The bottle storage compartment is usually refrigerated by means of a thermo-syphon system. In the brine line connecting the ice cream cabinet tank with the bottle cooling compartment will be found at least one hand valve. This hand valve must be open in order to obtain any brine flow and, therefore, any bottle cooling.

Cause No. 3—Insufficient brine.

If the brine level in the ice cream cabinet is low, there may not be sufficient brine to cover the outlet brine line leading to the bottle cooling compartment.

The obvious remedy is to add sufficient brine of the proper density to bring the brine level up to normal.

Cause No. 4—Clogged valve or brine line.

If the hand valve or the brine line is clogged (particularly with calcium chloride) no brine circulation will take place.

The remedy is to remove the hand valve or brine line and clean it out thoroughly. A new mixture of calcium chloride and water should be made, making certain that all of the calcium chloride is dissolved, and added to the brine tank in the usual manner.

COMPLAINT No. 11—Bottles are frozen.

This complaint will only occur on combination cabinets where both ice cream and bottle goods are stored.

Cause No. 1—Hand valve open too wide.

If the load on the bottle cooler is very light and the brine control hand valve is opened widely, it is entirely possible that the temperature of the bottle storage compartment will be reduced too low. The obvious remedy is to partially close the hand valve to throttle the flow of brine.

COMPLAINT No. 12—Electric light flicker.

Cause No. 1—Low voltage.

First check to see if there is not an excessive voltage drop between the power supply and the motor. If there is an excessive voltage drop, the installation must be rewired using the proper size of wire in accordance with the local electrical code.

If there is not an excessive voltage drop, call the local power company and ask to have the trouble corrected.

COMPLAINT No. 13—Radio interference.

Cause No. 1—Sparking between motor brushes and commutator.

First polish the commutator and then clean or renew the motor brushes if badly worn.

Cause No. 2—Motor not grounded.

The obvious remedy is to ground the motor by running a wire from the frame of the motor to the condensing unit base.

COMPLAINT No. 14—Overload protection blows out continuously.

Cause No. 1—Low oil level in compressor.

If the oil level becomes very low so that lubrication is not supplied to the moving parts, the power required to drive the compressor will become very high. The overload protection will blow out continuously.

The obvious remedy is to add sufficient oil to the crankcase to bring its level up to normal. A check should be made to make certain that the system has sufficient refrigerant charge for an insufficient refrigerant charge in a flooded system may be the cause of a low oil level.

Cause No. 2—Tight compressor.

A tight compressor will run very hot and it is very likely that the overload protection will blow.

First turn over the compressor by hand to see if it turns hard. Do not make the mistake of confusing good compression for a tight compressor.

Rather than attempt to correct on the installation, it is recommended that the compressor be removed and a new one installed. A tight compressor may be run in at the service shop.

Cause No. 3—Leaky compressor valves.

This point comes under the general heading of inefficient compressor. It has been previous covered under Complaint No. 1, cause No. 8.

Cause No. 4—High head pressure.

This problem has been considered previously under Complaint No. 4, cause No. 7.

Cause No. 5—Fuse too small.

On condensing units which are not equipped with motors having built-in overload protection, it is possible that the fuse installed in the electric circuit leading to the motor is too small.

The obvious remedy is to install a fuse of the proper size.

G-E 6-Month Orders Top Half Billion To Set Record

SCHENECTADY, N. Y.—Establishing a record for a six months' period, orders received by General Electric Co. during the first half of this year amounted to $521,139,000 compared with $212,653,000 for the same period last year, an increase of 145%.

Orders received during the three months ended June 30 amounted to $263,757,000, a record volume for a quarterly period, and were equivalent to an increase of 129% over the $115,163,000 of new business booked in the corresponding period a year ago.

Orders definitely known to cover equipment for national defense purposes amounted to approximately $216,000,000 in the first six months this year, including $104,000,000 received in the three months ended June 30, making a total of about $466,000,000 of such orders received since the defense program was instituted last year.

Security Metal Products Moves Plant, Offices From Kalamazoo

SAUGATUCK, Mich.—Offices and plant of Security Metal Products Co., Inc., manufacturer of Security locking nut, have been moved from Kalamazoo to Saugatuck.

Altorfer Bros. Appoints Cramer-Krasselt Co. as Advertsing Counsel

PEORIA, Ill.—Altorfer Bros. Co., manufacturer of ABC electric washers and ironers, has appointed Cramer-Krasselt Co., Milwaukee, as advertising counsel.

Refrigeration Supplies Moves To New Quarters

LOS ANGELES — Refrigeration Supplies Distributors, refrigeration supplies jobber here, has moved to new quarters at 3464 W. First St.

Proposed National Credit Reforms Would Tighten Terms To Avoid Gov't Control

NEW YORK CITY—Moving to take the lead in reforms in the present credit system, the National Retail Credit Association invited 15 national credit organizations to attend a special meeting set for Chicago on July 15 when a proposed national code was to be presented. The code is being proposed with the view of forestalling government regulation.

If approved as anticipated, the code will act as guiding principles to govern an estimated five to seven billion dollars in retail instalment sales this year, as well as bearing on another $1,000,000,000 or so of consumer credits arising from industrial banks and loan departments.

The code will be studied by a committee of three leading retail credit executives, according to David D. Bolen, new president of the N.R.C.A., which represents 17,000 retail credit managers. The committee includes Leopold L. Meyer, executive vice president of Foley Bros., Houston, who placed the proposal for the code before the recent convention here; Erwin Kant of Ed. Schuster & Co., Milwaukee; and Leroy T. Pease of Ovington's, New York City.

Draft of the code will probably be sent to the Department of Commerce and the final version to Price Administrator Leon Henderson and other government officials after action at the forthcoming meeting.

20% DOWN PAYMENT

Indications are that the proposed code will advocate a down payment of 20%, inasmuch as the convention passed a resolution calling for such an amount on instalment purchases and for shortening credit maturities by as much as 20 months in some cases. Although such a down payment is much greater than now called for by many retailers, it is still considerably lower than the one-third of the purchase price suggested by the Federal Reserve Board, and far below the 50% favored by the Treasury Department in case of war. The board, through Chairman Marriner S. Eccles, has indicated its desire to have all instalment business under its supervision.

Judging from suggestions already made, the code may also contain the following points: Service charges on purchases indicated on dollar rather than percentage basis; selective granting of credits to minimize risks and promote quicker liquidation of debt during high income periods; forehanded preparations for a return to normal after the emergency; closer cooperation between retailers, bankers, and loan companies, particularly relating to establishing more cooperative systems of interchange of credit information and control; and some action to solve the problems of smaller volume on large unit purchases and diversion of buying power presumably to "soft goods," posed by diversion of consumer demand from the durable goods field.

PROBLEM OF TRADE-INS

The question of trade-ins and their valuation would present a major problem in enforcement of terms of the code, according to Mr. Bolen, since a liberal trade-in policy has been a stumbling block in many of the instalment trades. Such a policy would become of paramount concern once the code establishes down-payment limits. Such is the case with regard to refrigerators, radios, sewing machines, washers, and to some extent furniture, as well as automobiles.

As Mr. Bolen sees it, once the code is accepted enforcement would be an all-important aspect of voluntary control. However, the feeling is that as soon as the code is approved by the government, the entire instalment field will rapidly fall in line and evasions will be speedily detected.

WHAT GOV'T FEARS

Belief that the government may deem it necessary to control instalment selling apparently is founded on the fear that the estimated $15,000,000,000 in increased purchasing power of consumers in the next year may cause big increases in instalment purchases. This in turn, according to theory, would start an inflationary spiral, and compete with the government for materials needed in national defense.

Many credit executives, while admitting such a possibility, answer that priorities, slashes in automobile and tire production, and price ceilings would effectively divert the needed materials for defense, and that voluntary control of credit would still allow purchasing power to expend itself in ways beneficial to customer morale and the standard of living.

W. G. Moehlenpah Heads Wisconsin A.S.R.E.

MILWAUKEE—W. G. Moehlenpah, an air conditioning engineer of the Chicago, Milwaukee & St. Paul railroad, has been elected chairman of the Wisconsin section of American Society of Refrigerating Engineers. Other officers are: vice chairman, Max E. Reuss, Vilter Mfg. Co.; secretary, Roy Morgan, Automatic Products.

CLASSIFIED ADVERTISING

RATES: Fifty words or less in 6-point light-face type only, one insertion, $2.00, additional words four cents each. Three consecutive insertions, $5.00, additional words ten cents each.

PAYMENT in advance is required for advertising in this column.

REPLIES to advertisements with Box No. should be addressed to Air Conditioning & Refrigeration News, 5229 Cass Ave., Detroit, Mich.

POSITIONS WANTED

AGGRESSIVE sales executive available for manufacturer of commercial refrigerators. Fifteen years experience sales management, sales promotion, organization in above field. Hired and trained salesmen, appointed dealers over entire United States. Splendid results. Pleasing personality, good habits, hard worker, age forty-five. Can furnish best references as to integrity and ability. Box No. 1338, Air Conditioning & Refrigeration News.

INDUSTRIAL Training Institute graduate available for employment in either the heating or refrigeration field. Prefer permanent connection with company in service or installation work or field engineering. Married, 30 years of age, and reliable. Write Box 1339, Air Conditioning & Refrigeration News.

SALESMAN: Constant producer, good closer, successful record. Fine reference. Now selling display cases, market coolers, air conditioning, etc., to retail merchants. Desire change due to limited territory. Will represent reputable dealer or manufacturer. Have excellent dealership contacts. Glad to tell you about myself. Reply Box No. 1341, Air Conditioning & Refrigeration News.

FRANCHISES AVAILABLE

A PROFITABLE set-up available to the right man to sell Warren Quality Refrigerators. We manufacture a complete commercial line with exclusive features that appeal to the trade. For complete details write WARREN REFRIGERATORS, INC., 420 Lexington Avenue, New York City.

SELL refrigerator display cases, walk-in coolers, reach-in refrigerators, refrigerating units, to meat markets, grocers, taverns, etc. Financing arrangements to help sell. Write for full information or see EHRLICH REFRIGERATOR MFG. CO., St. Joseph, Mo. Dept. A.

BUSINESS OPPORTUNITIES

FOR SALE: Established refrigeration supply business located in New York metropolitan area. Reply Box No. 1340, Air Conditioning & Refrigeration News.

EQUIPMENT WANTED

BUYERS of Surplus Stocks and Inventories of Commercial and Domestic Refrigeration and Air Conditioning Equipment, New, Rebuilt, Used. Condensing Units, Compressors, all sizes Motors, Controls, Valves, Heat Transfer Equipment, and all types of Parts. Please send full details and particulars. R & R REFRIGERATION & EQUIPMENT CO., 508 Morris Ave., Bronx, N. Y.

EQUIPMENT FOR SALE

SURPLUS STOCK: Brand new Westinghouse low-sides, complete with coils, valves, fans, manual controls, etc. One to two ton capacity. AC Models $32.50 each; DC models easily converted to AC $18.50 each. ½" Mueller strainers with ½" to ⅜" flare nuts 60¢ each in lots of 5. Complete stock "as is" or rebuilt commercial units. Three fan Frigidaire blower suitable for use on 3 HP condensing unit, ideal for beer cooler. "As is" and rebuilt refrigerators. Write for prices. ASSOCIATED REFRIGERATOR PLANT, INC., 3028 W. Hunting Park Ave., Philadelphia, Pa.

QUANTITY of "as is" commercial compressors mostly Frigidaire less motors which we have secured through replacement sales to our customers. No reasonable bid refused. S. J. O'BRIEN SALES CORP., 124 West 124th Street, New York City.

600-800 gal. per hour "DAY & NIGHT" water cooler CS2W140135 used only two months. Good buy for that bottling plant, circulating system, bakery, or air conditioning job. "DAY & NIGHT" list $1,660. My net F.O.B. Los Angeles $350. COMMERFORD'S REFRIGERATION CO., 3674 & 4629 Whittier Blvd., Los Angeles.

REPAIR SERVICE

CONTROL REPAIR Service. Domestic controls reconditioned equal to new at a small cost. All work guaranteed for one year. Prices upon request. UNITED SPEEDOMETER REPAIR CO., INC., 342 West 70th Street, New York City.

PATENTS

HAVE YOUR patent work done by a specialist. I have had more than 25 years' experience in refrigeration engineering. Prompt searches and reports. Reasonable fees. H. R. VAN DEVENTER (ASRE), Patent Attorney, 342 Madison Avenue, New York City.

OPACS Explains Purposes of Meetings On Consumer Durable Goods Industry

WASHINGTON, D. C.—This week the Office of Price Administration and Civilian Supply is holding meetings with representatives of eight consumer durable goods industries, for the purpose of securing information from industries involved on their raw material needs and the most suitable methods of making necessary curtailments.

Following is the schedule of the gatherings this week:

Morning, July 14—Commercial refrigerators

Afternoon, July 14 — Domestic laundry equipment

Afternoon, July 15—Automobiles

Morning, July 16—Air conditioning equipment

Afternoon, July 16—Metal furniture and furnishings

Morning, July 17—Heating equipment

Morning, July 18—Cooking stoves and ranges

Afternoon, July 18—Miscellaneous household appliances.

Just what OPACS is driving at in these conferences is indicated in an official statement on the subject, which reads as follows:

"Future retail supplies of consumers' durable goods made in whole or in part of scarce raw materials will be affected by a series of conferences beginning this week between the Civilian Supply Allocation Division of the Office of Price Administration and Civilian Supply and representatives of consumer goods industries which are important users of these materials.

"Defense requirements involving industrial raw materials in which there is a shortage, such as certain metals, make it necessary to curtail production of some civilian goods. The OPACS conferences are intended to work out allocation methods for the supplies of such raw materials remaining after military requirements have been met, in order to make provision for goods and services which are essential to civilian health and well-being.

"Industry representatives will be asked to make recommendations on the best ways of setting up the program in their particular industries. Where restrictions on raw material supply are necessary, manufacturers will be asked to indicate how they would prefer to see the restrictions applied—for example, in terms of volume of the finished product to be produced, or in terms of supplies of materials to be allocated. If the restriction is preferred in terms of materials, the industry will be asked to suggest procedures for cutting supplies which will be fair to all producers involved.

OPACS will also utilize the conferences to determine past and expected future raw material needs of the industries and to enlist voluntary industry cooperation in the program. On the basis of supplies available, essential civilian requirements and material needs of the different industries concerned, the allocations will subsequently be made. Effects on employment and production efficiency will also be weighed in the determinations.

"Among the specific problems to be discussed at the conferences are: Suitable formulas for converting reductions of material supply into reductions of products manufactured; the best distribution of the reduction in output among manufacturers of different capacities and different types of organization and operation; the time schedule of curtailment; the best geographical distribution of the items to be produced, considering health, climate, substitutes available, and other factors; methods of administering the curtailment program; ways of economizing the use of scarce materials; the best distribution of available products to distributors and consumers.

"The information and recommendations made at the conferences will enable OPACS officials to establish machinery for the allocation program. On the basis of the procedures set up for the more important industries, it is expected that allocation machinery will also emerge for lesser commodities involved.

"The first conference is being held with the refrigerator industry. This will be followed by meetings with the automobile, washing machine, oil burner, and other industries."

Philco Gets Big Order For Army Radios

PHILADELPHIA — Philco Corp. recently has received orders for approximately $1,300,000 of special communications equipment from the U. S. Government, reports James T. Buckley, president.

Among important contracts just awarded Philco is one for the manufacture of radio frequency measuring equipment, and another for a number of specially designed radio receivers for use in tanks. The order for tank receivers supplements a previous contract awarded Philco last November, on which deliveries have practically been completed.

The company also has been awarded a contract calling for the manufacture of several thousand high frequency radio receivers for aircraft use, as well as mountings, sets of tubes, and spare parts for this equipment. Philco research laboratories also are engaged in special defense research work in connection with the defense program.

Refrigerator Repair Parts Get Priority

(Concluded from Page 1, Column 4)

worn out or damaged parts, but that it did not include "replacement when the new part or parts represent a changeover in model, the introduction of a superior type equipment to replace usable equipment of an older or inferior type or design, or a substitution more extensive than that which is necessary to replace the part or parts that are worn out, damaged, or destroyed."

It was announced that the policy will be enforced and administered by the OPM priorities division.

Substitute Claimed For Zinc Coating

ELIZABETH, N. J.—Claimed as a suitable substitute for zinc coating of metal in refrigeration and air conditioning applications is "Roxaprene," a corrosion resistant speed synthetic manufactured by Roxalin Flexible Lacquer Co.

The synthetic is applied like the paint finishes in general use—dip, spray, or roller coat—and is said to involve only a fraction of the cost of galvanizing, and at the same time to provide greater production facilities because no additional processing is required.

Corrosion tests in a 2% caustic solution have shown Roxalene coated steel to be unaffected after 600 hours.

'Power Blackout' Lifted For Week In South

BIRMINGHAM, Ala.—The "power blackout" in the South was lifted last week, at least temporarily, and both residential and commercial users permitted to run their air conditioning and refrigeration equipment and turn on their electric lights as much as they pleased—after continuous rains had partially built up hydroelectric reservoirs in this area.

A check-up of reservoirs was to be made after the week's experiment to determine whether unlimited use could be extended for any considerable period. Present conditions, however, will provide ample power for all normal requirements as well as special requirements of national defense, it was indicated.

J. M. Barry, vice president and general manager of Alabama Power Co., announced that restrictions would be lifted for at least a week on all residential, commercial, and industrial uses, but urged that industrial plants continue night and week-end operations to level the daytime and week-end demands on power facilities.

In Georgia, C. A. Collier, vice president of Georgia Power Co., said that unlimited residential and commercial consumption would be permitted for one week, but that limited restrictions would be continued on industrial uses.

After a month's blackout, return of street and store lighting gave Birmingham almost a gala appearance. Operation of air conditioning systems, reduced to an absolute minimum during the restriction period, also was increased.

Electrical appliance sales fell off somewhat, while general power consumption dropped 25%.